Getting Started with MAINVIEW® for DB2® and RxD2™

MAINVIEW® for DB2® 7.1
RxD2™ 2.1

Version 7.1

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bmcsoftware

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  - product name
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  - license number and password (trial or permanent)
- operating-system and environment information
  - machine type
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  - system hardware configuration
  - serial numbers
  - related software (database, application, and communication) including type, version, and service pack or PTF
- sequence of events leading to the problem
- commands and options that you used
- messages received (and the time and date that you received them)
  - product error messages
  - messages from the operating system, such as `file system full`
  - messages from related software

Contents

About This Book

This tutorial is intended for first-time users of MAINVIEW for DB2 and RxD2. It takes you step-by-step through practice sessions with several fundamental product applications.

Note: You will need appropriate DB2 authorization to execute certain steps.

Conventions Used in This Book

The following syntax notation is used in this tutorial:

- Items you type and keys you press are highlighted with **bold** letters.
- An item in CAPITAL LETTERS must be entered exactly as shown.
- Items in lowercase letters are values you supply.
- A vertical line | separates alternative options; one must be chosen.

The term pop-up refers to an ISPF pop-up display that replaces the original screen image.

Chapter 1. Quick Reference Card

This chapter contains a quick reference card for your use. You can tear it out and keep it by your terminal if you wish.

It contains

- A brief list of where you should start looking when you want information about a certain topic
- Examples for defining requests

Important

If you are a new user, be sure to go through each of the practice sessions in the rest of this book before using the quick reference card.

Quick Reference Card MAINVIEW for DB2

Where to Start

To See	Start Here
DB2 Primary Option Menu	Option 5 on MAINVIEW Selection Menu
Multiple DB2s	EZDSSI Easy Menu
One DB2	EZDB2 Easy Menu
Applications analysis	EZDBA Easy Menu
Tuning wizards	EZDWIZ Easy Menu
All windows-mode views	MAIN (or VIEWS) view

A full-screen-mode service from windows mode	EZDFAST Easy Menu
	or
	`TRANsfer target product;service`
	
	Examples: `TRAN DB2P DB2;LOG` or
	`TRAN DB2P DB2;EX LOCKD`

A windows-mode view from full-screen mode	Option V or `TRANsfer target MVDB2;view`
Status of all DB2s	STDB2 view
Detail status of one DB2	STDB2D view or DB2ST (Option 1) (full-screen mode)
Current threads	THDACTV view or USERS (full-screen mode)
Current locks	LOCKD or LOCKU (full-screen mode)
Lock contention analysis	Lock Analysis tuning wizard (WZLOCK view)
Data sharing analysis	Data Sharing tuning wizard (WZDSHAR view)
Page sets	EZDPS Easy Menu
I/O analysis	EZDPS Easy Menu or Option 7 (full-screen mode)
Buffer pools	EZDBFRPL Easy Menu
Group buffer pools	EZDSSI / EZDBFRPL Easy Menus or Data Sharing tuning wizard (WZDSHAR view)
Monitors	EZDB2 / EZDSSI Easy Menus
Workload objectives	EZDB2 / EZDSSI Easy Menus
Current traces	Option 4 (full-screen mode)
History traces	Option 5 (full-screen mode)
Recent workload history	Option 6 (full-screen mode)
DB2 catalog information	RxD2 (RX option)

How to Activate Requests

- **To define requests for automatic startup** (BLKDMRW member in BBPARM):
  - Summary Trace example

```
REQ=ATRAC THRDHIST  TYPE=SUMMARY  TITLE='THREAD HISTORY'  STORAGE=4000K
    LOGTRAC=Y   TRNUMDS=3   TRSWTIME=24:00 TRDSN='Mypfx.Trace.Dsn.V01'
```

  - Detail Trace example

```
REQ=ATRAC DETLABC  DB2PLAN=ABC  TYPE=SQL,SCAN,IO
    STORAGE=4000K  WRAP=Y  TITLE='I/O TRACE OF ABC' GROUPSQL=Y
    TRBUFF=5, TRSIZE=800K
```

  - Monitor example

```
REQ=BPUTL BP0  WMAX=85  I=00:01:00 WLIM=99  LOG=ATWARN
```

  See “SET Keyword Parameter Options” in Volume 2 of the *MAINVIEW for DB2 User Guide* for a complete description of all the keywords you can use.

- **To define requests to check active thread exceptions** (“runaway queries”) or other background exception conditions (DMRBEX00 member in BBPARM):
  - TSO Exception example

```
MSG=DZ0630W,CPUTOT=1000,GPTOT=100000
```

  See sample member DMRBEXBB in BBPARM or “Part 4 - Monitors” in Volume 2 of the *MAINVIEW for DB2 User Guide* for a complete list of all the background monitors.

  To display the active background samplers, you can type **`BG ON`** from the Active Timer Requests application (Option 3).

- **To activate, modify, or purge individual traces,** use the Start Trace panels (ST option from Current Traces (Option 4)).

- **To activate, modify, or purge individual monitors,** use the Start Monitors panels (SM option from Active Timer Requests (Option 3)).

- **To activate a block request with additional monitors or traces manually,** type on any full-screen display:

```
SERV ===> SET
PARM ===> BLK=blkmbrname
```

  where `blkmbrname` is BLKDMRW or a user-created block request member in BBPARM.

- **To purge all existing requests from BLKDMRW manually,** type on any full-screen display:

```
SERV ===> SET
PARM ===> PRG=BLKDMRWP
```

Chapter 2. Isolating DB2 Performance Problems

These scenarios teach you how to navigate easily through the MAINVIEW for DB2 views and displays and use the available facilities. They do not show you every area covered by the product or all of the displays.

In this practice session, you

1. Check status and activity of all DB2s to detect potential problem areas.
2. Analyze a single DB2 to study problem areas in more detail.
3. Use monitors to isolate specific resource- or workload-related problems.
4. Review critical problems, including those just identified by workload monitors.

See the *Using MAINVIEW* manual for a complete description of how to work in both windows mode and full-screen mode.

Note: This practice session takes approximately one hour to complete.

Enter MAINVIEW

If you are new to MAINVIEW, you should get a copy of the document *Quick Start with MAINVIEW* before starting. This consists of a few stapled pages that cover the basic things you need to know to use any MAINVIEW product. The first page has some blank lines that should be filled in with your startup options. See *Using MAINVIEW*, TD-906, for more detailed information.

Accessing MAINVIEW for DB2

Enter MAINVIEW by executing the MAINVIEW CLIST, selecting an ISPF panel option, or logging on to a VTAM session. Then go to Option 0 to specify your CASID, and, when this is done, return to the MAINVIEW Selection Menu, as shown in Figure 1.

```
--------------------------- MAINVIEW Selection Menu ---------------------------
OPTION  ===> 5                                                DATE   -- 3/17/01
                                                              TIME   -- 15:36:58
   0  Parameters    Specify MAINVIEW options                  USERID -- BOLLAA2
   1  PLEXMGR       MAINVIEW Plex administration              MODE   -- ISPF 4.2
   2  FOCAL POINT   Subsystem monitoring and alerts
   3  AutoOPERATOR  Automation and resource control
   A  MVALARM       MAINVIEW Alarm management
   T  InTune        Program analysis and tuning
   V  VistaPoint    Comprehensive view of applications and resources

 MAINVIEW for
   4  CICS          CICS performance and control
   5  DB2           DB2  performance and control
   6  IMS           IMS  performance and control
   7  MVS           OS/390 (MVS) performance and control
   8  MQSeries      MQSeries performance and control
   9  USS           UNIX System Services performance and control
   N  Networks      Network performance and optimization

   X  EXIT          Terminate MAINVIEW


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```

Figure 1. MAINVIEW Selection Menu

You can enter any installed MAINVIEW product from this menu. Start by selecting Option 5 to access MAINVIEW for DB2.

Check DB2 Status and Activity

Begin by accessing the MAINVIEW for DB2 Primary Option Menu, as shown in Figure 2.

Analyzers
Monitors
Traces

Thread History

Views

DB2 Catalog

DB2 Console

```
BMC Software --------------- PRIMARY OPTION MENU ------- MAINVIEW for DB2 7.1.0
OPTION  ===> V                                             DATE   -- 3/17/01
                                                           TIME   -- 13:45:08
    Managing DB2 Performance:                              USERID -- CIR11
      1  STATUS         - DB2 Status (DB2ST)                MODE   -- ISPF 4.2
      2  ANALYZERS      - Current Status/Activity Displays
      3  MONITORS       - Early Warnings/Recent History (Active Timer Requests)
      4  TRACES         - Current Application Traces
      5  HISTORY TRACES - Historical Trace Data Sets
      6  GRAPH          - Recent Thread History
      7  I/O            - DB2 I/O Analysis
      8  BBI INFO       - BBI Subsystem Information
      V  VIEWS          - Windows Mode (New Facilities)

    DB2 administration:
      RX RxD2 FlexTools

    General Services:
      C  CYCLE SETUP  - Service Refresh Cycle Setup
      L  LOG DISPLAY  - Display Logs
      M  MESSAGES     - Display Messages and Codes
      K  KEYS         - Current PF Key Assignments
      T  TUTORIAL     - Tutorials/News/Getting Started       PF1/13: HELP
      X  EXIT         - Terminate                            PF3/15: EXIT
```

Figure 2. MAINVIEW for DB2 Primary Option Menu

From here, you have direct access to all facilities provided by MAINVIEW for DB2. Most of the options shown here provide direct access to data displays and control panels for managing a single DB2 at a time. You can change the target DB2 directly on almost every screen. Most of these functions operate in full-screen mode.

However we are first going to investigate the capabilities of the windows-mode views, since they are specially designed to provide an overview of multiple DB2 subsystems at a time, as well as drill-down to details about any single DB2.

Point-and-shoot *hyperlinks* take you from one view to other displays with related information. Sometimes these displays are further windows-mode views; sometimes they are full-screen displays normally accessed through these menu options.

Check Status of All DB2s

To access windows mode and get acquainted with the views available for monitoring multiple DB2s at a time:

1. From the Primary Option Menu, select the **VIEWS** option.

   ```
   OPTION ===> V
   ```

   The DB2 SSI Easy Menu (EZDSSI) is displayed, as shown in Figure 3.

Window Information Line ==>

DB2 Overview

```
17MAR01  16:32:36 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =EZDSSI===========(ALL======*=======)17MAR01==16:37:22====MVDB2====D====1
                               DB2 SSI Easy Menu
    Status                                                  Threads
  . Overview                 +----------------------+  . Current Threads
  . Exceptions               |   Place cursor on    |  . DB2 Summary
  > Buffer Pools             |    menu item and     |  . Attach Summary
  > Status Menu              |     press ENTER      |  . Connect Summary
                             +----------------------+  . Plan Summary

    Data Sharing               Monitors
  . GBP Group Status         . In Warning                  Tools And Menus
  . GBP Group Activity       . Summary By Area           . Set SSI Context
  . Global Lock Stats        . Active                    > Easy Menu
  . Global Lockouts          . Workload Objectives       > MAIN Menu
  . Volume I/Os (SSI)                                    > Tuning Wizards
  > Page Set Menu                                        . Return...
```

Figure 3. DB2 SSI Easy Menu (EZDSSI)

2. Look at the fourth line from the top.

   This is the *window information line.* It shows the number of this window (since you may later have several windows open at once), the name of this view (EZDSSI), the current target context (ALL), date, time, and product (MVDB2).

   This view is an example of an Easy Menu that provides hyperlinks to various other views.

   Note: Options prefixed with a period take you directly to data, while options prefixed with a “>” take you to another menu.

   This EZDSSI Easy Menu is designed to be used in Single System Image (SSI) mode to look at multiple target DB2s at one time.

3. There are two hyperlinks to other Easy Menus that can be used to check out DB2 status:

   - **Status Menu** provides options to select the many views that show complete DB2 statistics (EZDSTAT). EZDSTAT hyperlinks generally go to tabular views that show one row per DB2 with detail views accessible from there.
   - **Buffer Pools** provides options to show status and statistics for individual buffer pools (and group buffer pools).

   Look at these menus but don’t go further now. You can come back here later.

4. To check the status of all DB2s, put your cursor on the **Overview** hyperlink and press **Enter**.

   This takes you to the STDB2 view, as shown in Figure 4, maintaining the default context of ALL, which includes all defined DB2s.

Check Status of All DB2s

```
17MAR01  16:41:51 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =STDB2============(ALL======*=======)17MAR01==16:41:51====MVDB2====D====3
 DB2        Act   Comm  Getpg  Lockout Total                Dataset  Dataset  G
 Target     Thrd  Rate   Rate     Rate Excpt Warning Msg     In-Use     Open
 DB0GC         0   0.0    0.0      0.0     0 Connect Fail         0
 DB0HC         0   0.0    0.0      0.0     0 Connect Fail         0
 DB1GC         0   0.0    0.0      0.0     0 Connect Fail         0
 DB1HC         2   0.0    0.1      0.0     0 GBL cont >2%         4       18
 DB2GC         0   0.0    0.0      0.0     1 Connect Fail         0
 DB2HC         5   0.0   11.0      0.0     0 GBL cont >2%        16       37
```

Figure 4. DB2 Activity Overview (STDB2)

With this view, you can quickly gauge how well each of your DB2 subsystems is performing by reviewing and comparing the number of active threads, key activity rates, a total exception count, and the most critical warning condition that exists right now (if any). Notice the “>” sign before the W1 in the information line. This indicates that you can scroll right for more data.

Later you will see how you can move these fields around and set thresholds to customize the view to meet ***your*** monitoring needs exactly (or even create different views for different conditions).

5. Several of the column headers are highlighted, indicating that you can choose a row in that column. This hyperlinks to a view with more detail (related to that column) for the selected DB2.

   If you see a warning message for one DB2, place the cursor on that message and press **Enter** to see a list of all the warning conditions that are tracked per DB2. If multiple conditions exist at the same time, only the most important is shown in STDB2, and the others are set to YES in this view. Press **PF3** to return to STDB2.

   Note: You can do this hyperlink to see the list even if the warning message field is blank (all the conditions will be set to NO).

6. Hyperlink on the **DB2 Target** field for an active DB2 to see a detail status view.

   You will return here later. Press **PF3** to return to STDB2.

7. Hyperlink on the **Comm Rate** field for an active DB2 to see counts and rates of activity in that DB2, both for the current interval (1 to 15 minutes) and for the total session data since DB2 startup.

Interval and Session Counts

```
17MAR01  16:37:54 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =STDB2====STRATE==(ALL======DB2HC===)17MAR01==16:37:52====MVDB2====D====1
               Interval    Session  Interval   Session  Interval   Session    I
                    Qty        Qty      Rate      Rate   /Thread   /Thread

 Commits.....        16         52       0.0       0.0       2.0       1.1
 Thd Creates.         8         46       0.0       0.0

 Getpages....     18431      30434      38.8       1.2    2303.9     661.6
 Page Updates       209        211       0.4       0.0      26.1       4.6
 Sync I/O....       259        560       0.5       0.0      32.4      12.2
 Prefetch I/O      2153       3502       4.5       0.1     269.1      76.1
 Write I/O...         4          5       0.0       0.0       0.5       0.1
 DatasetOpens        16         45       0.0       0.0       2.0       1.0

 Lockouts....         2          2       0.0       0.0       0.2       0.0
 LockSuspends        21         51       0.0       0.0       2.6       1.1
 GBLLockCont.        36        924       0.1       0.0       4.5      20.1
 Clm/Drn Fls.         0          0       0.0       0.0       0.0       0.0
 DML SQL.....      1196       1700       2.5       0.1     149.5      37.0
 StProcCalls.         0          0       0.0       0.0       0.0       0.0
 StProcFails.         0          0       0.0       0.0       0.0       0.0

 RID Fails...         0          0       0.0       0.0       0.0       0.0
 EDM Loads...         5         10       0.0       0.0       0.6       0.2
 EDM Fails...         0          0       0.0       0.0       0.0       0.0
 Checkpoints.         0          1       0.0       0.0       0.0       0.0

 Prll Groups.         0          0       0.0       0.0       0.0       0.0
 PrllFallback         0          0       0.0       0.0       0.0       0.0
```

Figure 5. Activity Rates (STRATE)

Again, some of these fields are highlighted, indicating that hyperlinks will take you to even more detail.

8. Press **PF3** to return to STDB2.

Current Thread Activity

From the DB2 status overview (STDB2), you can access current thread information:

1. Hyperlink on **ACTV THRD** to view a list of all active threads in the selected DB2, as shown in Figure 6.

All Active Threads

```
17MAR01  11:59:34 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =THDACTV==========DB2H=====*========17MAR01==11:59:20====MVDB2====D====3
          DB2  Connect               Elapsed              SQL
 Auth ID  ID   Name      CPU Time     Time       %CPU   Stmts Warn  Locks User
BOLHHH4  DB2H DB2CALL  00:01:22.06 00:08:24.48   2.1       2 No        8 ACTIV
BOLLAA2  DB2H DB2CALL  00:01:07.16 00:05:58.88   0.8   23251 No       15 ACTIV
BOLLAA2  DB2H DB2CALL  00:00:00.00 00:00:02.11   0.0       2 No        4 SWAPP
DMRC     DB2H DB2CALL  00:00:32.12 05:40:25.95   0.0       0 No        0 BBI M
```

Figure 6. All Active Threads for One DB2 (THDACTV)

2. Type **SORT D** on the COMMAND line, move your cursor to the **Elapsed Time** header, and press **Enter** to sort the threads by the length of time they have been active.

3. Hyperlink on one thread by placing your cursor in the **AUTH ID** column to see a detail display for that thread, as shown in Figure 7.

Detail User

Expand to Locks Held =>
SQL Detail =>

Expand to SQL Detail =>

SQL Statement

```
 BMC Software --------------   DETAIL USER STATUS    -------------  RX AVAILABLE
 SERV ==> DUSER           INPUT    15:01:07  INTVL=> 3  LOG=> N  TGT==> DB2G
 PARM ==> BOLHHH4                             ROW     1 OF    80 SCROLL=> CSR
 EXPAND:  MON(USER), UTRAC, ST(START TRACE), LOCKE, EXPLAIN, PT, CICSE, CMRTASK
          ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, SPAS, DDF
 CURRENT........11:07:13.53 PLAN..............DSNESPRR TYPE..............ALLIED
 START..........10:58:49.39 AUTHID.............BOLHHH4 CONNECT..........TSO/TSO
 ELAPSED...........00:08:24 ORIG PRIM AUTH.....BOLHHH4 CORR ID.....BOLHHH4
 STATUS..............IN-DB2 COMMITS..................0 ROLLBACKS..............0
 ------------------------------------------------------------------------------
 RUNTIME ANALYSIS   IN DB2     IN APPL.      TOTAL      %IN DB2(=)     TOTAL(*)
 ----------------   --------   --------   --------     0 ...25...50...75..100%
 ELAPSED TIME       00:08:23     718 ms   00:08:24     | ==================* |
 CPU TIME           00:01:22     123 ms   00:01:22     | ===                 |
 DB2 WAIT TIME         20 s                            | <                   |
 - - - - - - ACTIVITY - - - - - -      - - - - - KEY INDICATORS  - - - - - - -
 TOTAL SQL.....................2      SQL: DYNAMIC(PREPARE)=     1
 GETPAGES.................416,803     I/O RSP: SYNC=    45 ms, ASYNC=   107 ms
 SYNC READS (PRLL=00) .........147
 PREFETCH PAGES READ.........1,051
 UPDATES/COMMIT................0.0
 BFR HIT RATIOS:...VP=100%,HP=100%
- - - - - - - - - - - - - - -SQL STATEMENT ANALYSIS - - - - - - - - - - - - - -
STATEMENT #:    193                  STATEMENT TYPE:  OPEN
ACTIVE IN DB2               CPU TIME: 1,897 ms     ELAPSED TIME: 00:01:06
Package/DBRM: DSNESM68  (DYNAMIC)           PLAN ISOLATION LEVEL: RR
PROCEDURE/UDF/TRIGGER:  DSN8SPAS_TEST
SELECT * FROM LONG_SQL ;
```

Figure 7. Detail User Status Display (DUSER)—Base Section

This display shows all available accounting detail information about that thread. The most critical data is summarized in the base section, including key indicators of failures or potential problems. You can scroll down, use the expand buttons, or point-and-shoot to view complete detail data. Also, the DB2 thread cancel command can be invoked with a CANCEL parameter if you have the proper authorization.

4. The full text of the current SQL statement being executed is available near the bottom of this base section.

   If your window size is too small to show the full text, position the cursor on the first text line and scroll down with **PF8**.

   Notice that this section also includes the current package/DBRM name and the time this SQL statement has been active.

5. Tab to the **SQLCOUNTS** button or to the **TOTAL SQL** line and press **Enter** to view a breakdown of all SQL executed by this thread.

6. Press **PF3** once to return to the DUSER base section.

7. If this is an active IMS or CICS thread and if MAINVIEW for IMS or MAINVIEW for CICS is installed, the detail display will include an expand button to expand directly to that product:

   - MAINVIEW for CICS: TASKXPND display for this CICS transaction
   - MAINVIEW for IMS: DREGN display for the region processing this IMS transaction

   Press **PF3** once to return to DUSER.

8. There are many other sections of detail data with which you will get acquainted over time. For example, if you are concerned about locking, you could choose the **LOCKE** expand button to see all the locks held (or waited on!) by this thread and any threads in contention with it.

9. Press **PF3** several times to return to EZDSSI.

Exceptions Overview

Exception Conditions

Another way to check for exception conditions in any of your DB2s quickly is to choose the **Exceptions** hyperlink on EZDSSI to bring up the view STEXC, as shown in Figure 8.

```
17MAR01  16:52:20 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =STEXC============(ALL======*=======)17MAR01==16:50:58====MVDB2====D====4
 DB2      Warning  System     User
 Target   Monitors Exceptions Exceptions Warning Msg
 DB1GC           0          0          0 Connect Fail
 DB1HC           0          0          0 GBL cont >2%
 DB2GC           0          0          0 Connect Fail
 DB2HC           1          0          0 GBL cont >2%
```

Figure 8. Exception Conditions (STEXC)

This view identifies immediately whether or not any exceptions have been detected, and shows what kind they are. Hyperlinks lead to additional details.

Warning Monitors show conditions that have been detected by timer-driven sampling monitors defined with warning thresholds. Typically, a predefined group of monitors is started automatically and it is always active. A later section provides more information on monitors.

System Exceptions are conditions that are detected by a background sampler and are not governed by a threshold; for example, a problem with log archiving.

User Exceptions are thread-related conditions detected by a background sampler. Threshold conditions can be defined per attach type; for example, IMS, CICS, or batch.

The first three types generate warning messages that can be viewed while active, tracked historically in the journal log, or fed into an automated operator product like MAINVIEW AutoOPERATOR.

Warning Msg shows the most important of several conditions that are checked per interval, and on request, as part of the total DB2 status and statistics data collection for windows-mode views. These conditions may also be identified by one of the other exception samplers.

1. If you have a non-zero value for any of these counts, follow the hyperlinks to see further details.
2. When finished, press **PF3** as needed to return to EZDSSI.

Thread Activity for Multiple DB2s

From EZDSSI, you can choose hyperlinks to view thread activity across multiple DB2s:

1. Hyperlink on **Current Threads** to see all active threads, identified by the DB2 they are running in.
2. Hyperlink on **DB2 Summary** to see a summary of threads for each DB2; then hyperlink on **one row** to view a list of threads for just that DB2.

Analyze One DB2

One DB2

From EZDSSI, choose the **Easy Menu** hyperlink to access an Easy Menu designed to analyze one DB2 at a time, EZDB2, as shown in Figure 9. This selects one DB2 from the context of ALL.

```
17MAR01  12:41:15 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =EZDB2=============DB2HC====*========17MAR01==12:41:14====MVDB2====D====1
                              DB2 Easy Menu
          DB2 Target --->  DB2HC
    Status                                          Threads
  . Overview                +----------------------+  . Current Threads
  . Exceptions              |   Place cursor on    |  . Attach Summary
  . Buffer Pools            |    menu item and     |  . Plan Summary
  . DDF Connections         |     press ENTER      |  . Thread History
  . Activity Rates          +----------------------+  . Current Traces
  > Status Menu                                       . History Traces

    Lockouts                  Monitors                Tools And Menus
  . Events                  . In Warning              . Set Target Context
  . Resource Summary        . Summary By Area         . DB2 Catalog/Explain
  . Connection Summary      . Active                  > SSI Easy Menu
  . Blocker/Waiter Summary  . Workload Objectives     > DBA Easy Menu
                                                      > Fast Menu
    Page Sets                                         > MAIN Menu
  . Page Set Status                                   > Tuning Wizards
  . Volume I/O Summary                                . Return...
  > Page Set Menu
```

Figure 9. DB2 Easy Menu (EZDB2)

To select the target DB2 you want to analyze:

1. Hyperlink on **Set Target Context** to see a list of targets; then place your cursor in the **Target** column and press **Enter** to hyperlink to a different target.

   Note: If you already know the DB2 target you want, simply type **`CON target`** on the COMMAND line.

2. Notice in the **Tools And Menus** section, there are hyperlinks to RxD2 (DB2 Catalog/Explain) as well as several other Easy Menus.

Check DB2 Status

To check the status of the target DB2:

1. Hyperlink on **Overview**.

   This takes you to the STDB2 view, as shown in Figure 4 on page 9, but only the one DB2 is displayed.

2. Now you may want to review recent history.

   Type **`TIME * * 2H`** to see the last 2 hours by 15-minute intervals. Type **`INCLUDE TIME`** to see the times (the Intvl Time column is added to the view), as shown in Figure 10.

Review History

```
17MAR01  16:57:55 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =STDB2=============DB2HC====*========17MAR01==16:57:54====MVDB2====D====1
 DB2       Intvl  Act   Comm  Getpg  Lockout Total                Dataset  Data
 Target     Time  Thrd  Rate   Rate     Rate Excpt Warning Msg     In-Use     O
 DB2HC         5   0.0    4.7      0.0     0 GBL cont >2%         4       63
```

Figure 10. DB2 Activity Overview (STDB2)

You can hyperlink on a time period for further analysis if desired. (Don't do it now though.)

3. Reset to current time with **`TIME * * 1I`** and then **`EXCLUDE TIME`**.

4. Hyperlink on **DB2 Target** to see a detail status view, as shown in Figure 11.

Detail Status View

```
17MAR01  16:58:31 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =STDB2====STDB2D===DB2HC====*========17MAR01==16:57:54====MVDB2====D====1
  > EZ Menu     .Session
                Connect   Active      In DB2      Queued      Suspended    CPU%
  TSO........         1        1           0           0              0     0.0

  Batch......         4        4           2           0              1    32.0
  -CAF.......         4        4           2           0              1    32.0
  -Utility...         0        0           0           0              0     0.0

  IMS........         0        0           0           0              0     0.0
  CICS.......         0        0           0           0              0     0.0
  DBAT.......         0        0           0           0              0     0.0
  SPAS.......         9        0           0           0              0     0.0
  RRSAF......         0        0           0           0              0     0.0
  *Total*....        14        5           2           0              1    32.0

                           0...50.100              0...50.100
  GBL cont >2%  EDM Pool               Total CPU%

  BP Rates:..   Getpage      4.7      Reads            0      Writes        0.0
  Locking:...   Suspend        0      Deadlocks        0      Timeouts        0
  Exceptions:   Monitor        0      System           0      User            0
  Data Sets:.   Open          63      Open HWM        63      In-use          4
  Parallel:..   Maximum        0      Groups           0      Fallback        0
  STOPROCS:..   Calls          0      Abends           0      Timeouts        0
  Group BP:..   Reads          2      Writes           2      Failures        2
  Paging:....   DB2          0.0      System         0.0
  DB2 Start:.   Date      17MAR01   Time        09:19:46
```

Figure 11. DB2 Status Detail—Interval (STDB2D)

This shows an overview of current thread activity per attach type as well as key indicators of recent performance.

5. Use the **.Session** hyperlink at the top of the view to see totals since DB2 startup instead of current interval values in the key indicator fields.

6. The **EZ Menu** option takes you to EZDSTATD.

   This Easy Menu is very similar to the DB2 Status Easy Menu, EZDSTAT, that you saw earlier, but the hyperlinks here take you directly to all the detailed statistics views for this DB2.

7. Hyperlink on **SQL Counts** to see STSQLD as an example of these detailed statistics views, as shown in Figure 12.

Detailed View

```
17MAR01  17:01:51 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =STDB2====STSQLD===DB2HC====*========17MAR01==16:57:54====MVDB2====D====1
                            Interval   Session
 Data Manipulation Language
  SELECT.................        0         0
  INSERT.................        0         0
  UPDATE.................        2         6
  DELETE.................        0         0
  DESCRIBE...............        0         0
  PREPARE................       12       205
  OPEN...................       10       199
  FETCH..................      150     46998
  CLOSE..................        9       197
 Data Definition Language..
  CREATE TABLE...........        0         0
         INDEX...........        0         0
```

Figure 12. SQL Counts Detail (STSQLD)

8. Press **PF3** to return to EZDSTATD.

   You may want to browse a few other detail views.

9. Press **PF3** to return to STDB2D.

10. Hyperlink on **TSO** to see a tabular view of current TSO users.

11. We have stepped through several status views now. However, some information is not available in windows mode. Examples are information about CICS connections, DB2 logging, DSNZPARM values, and so forth.

    To access these displays, simply press **PF3** to return to the Primary Option Menu, or you can use one of the following quick paths:

    - From EZDB2, choose the **Fast Menu** to get a menu of hyperlinks into full-screen mode.
    - Use the transfer command at any point to access the full-screen DB2 Status display DB2ST. This is similar to STDB2D, but it provides point-and-shoot to most full-screen displays, such as CICSC (to see CICS connections), ZPARM, and so forth.

      `TRAN target DB2;EX DB2ST`

      You can also use the transfer command to access other MAINVIEW products.

Buffer Pools

To analyze buffer pools for the target DB2:

1. From EZDB2, hyperlink on **Buffer Pools** to see a list of all defined pools with allocated space, utilization, and getpage rates, as shown in Figure 13.

All Defined Pools

```
17MAR01  17:04:18 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =BFRPL=============DB2HC====*========17MAR01==17:04:18====MVDB2====D====9
 Pool   DB2      Vpool Vpool  Hpool  Hpool  Getpg  Get-    %     % Active
 Name   Target    Size Alloc   Size  Alloc   /sec  pages  Actv 0.....50....100
 BP0    DB2HC      200   200      0         143.2  37236     0
 BP1    DB2HC       25            0           0.0      0     0
 BP2    DB2HC       25           30           0.0      0     0
 BP4    DB2HC       21            0           0.0      0     0
 BP5    DB2HC       30            0           0.0      0     0
 BP9    DB2HC       20            0           0.0      0     0
 BP11   DB2HC      400            0           0.0      0     0
 BP32K  DB2HC       20            0           0.0      0     0
 BP32K9 DB2HC       20            0           0.0      0     0
```

Figure 13. Buffer Pool Statistics—SSI (BFRPL)

2. Hyperlink on **Pool Name** to see all status and statistics for one pool.

   Both interval and session counts are shown, as shown in Figure 14.

Statistics for One Pool

```
17MAR01  17:05:05 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =BFRPL====BFRPLD===DB2HC====*========17MAR01==17:04:18====MVDB2====D====1

 Pool Name.......................      BP0
 VP Size.........................      200
 Hiperpool Size..................        0
 Virtual Pool Sequential Threshold       80
 Hiperpool Sequential Threshold...       80
 Deferred Write Threshold........        50
 Vertical Write Threshold........        10
 Castout Attribute Y/N...........         Y
 Parallel Sequential Threshold....       50
 Assisting Parallel Threshold.....        0

                                  Interval   Session
 Virtual Pool Allocation.........
   Buffers Allocated.............                200
   Current Active Buffers........                  1
   Expansions/contractions.......        0         0
   No Buffer - Pool Full.........        0         0
   Expansion Fail................        0         0
 Hiperpool Allocation............
   Expanded Storage Buffers......                  0
   Buffers Allocated.............                  0
   Expansions/Contractions.......        0         0
 Virtual Pool Read Statistics.....
   Getpages......................    37236    135607
   Sequential Getpages...........    36910    128765
   Sync I/O......................      104      1657
   Sequential Sync I/O...........        0       289
```

Figure 14. Local Buffer Pool Statistics Detail (BFRPLD)

3. Scroll down with **PF8** to see all the data. Press **PF3** to return to BFRPL.
4. Hyperlink on **Getpg/sec** to see current hit ratios per pool (BFRPLH); then hyperlink on **Pool Name** to see both current and session ratios (BFRPLHD) for one pool, as shown in Figure 15.

Hit Ratios

```
17MAR01  17:07:12 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =BFRPL====BFRPLHD==DB2HC====*========17MAR01==17:04:18====MVDB2====D====1
 Pool Name..................... BP0

                               Interval   Session
 Hit Ratios.....................
  VPOOL Hit Ratio % with P/F...    17.51     18.55
  VPOOL Hit Ratio % without P/F    92.64     81.70
  GBP Hit Ratio %..............     0.00     18.92
 Activity per Second...........
  Getpages.....................   143.20      4.87
  Page Updates.................    29.78      0.61
  Sync I/O.....................     0.40      0.06
  Prefetch I/O.................    15.51      0.51
  Write I/O....................     0.80      0.02
  Data Set Opens...............     0.00      0.00
```

Figure 15. Buffer Pool Rates Detail (BFRPLHD)

5. Press **PF3** to return to EZDB2.

   Group buffer pools are discussed later in the data sharing section (see “Tune Group Buffer Pools” on page 54).

Lock Contention Analysis

Although locking problems must usually be resolved at the application level, the first indication of problems—and the simplest identification of the applications and resources involved—can best be seen at the system level. To use the options in the Lockouts section of EZDB2 to look at locking problems in one DB2 (without data sharing):

1. If you aren't sure whether or not you are having much lock contention, you may want to review the lockout and suspension counts and rates first in the STRATE view (hyperlink on **Activity Rates**).

   A certain number of lock suspensions (and even an occasional timeout or deadlock) is to be expected in an active DB2 system. More frequent lockout conditions (either timeouts or deadlocks) may be a cause for concern, since the SQL statements involved are terminated.

2. You can hyperlink to see a list of the last 100 timeouts and deadlocks either from the **Lockouts** field in STRATE, or from **Lockout Events** on EZDB2.

   Both go to the view LKEVENT, as shown in Figure 16.

Timeouts and Deadlocks

```
17MAR01  17:20:11 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKEVENT===========DB2HC====*========17MAR01==17:20:10====MVDB2====D====5
 Date / Time    Lockout   Victim   Victim   Victim   Victim Victim        Nr.
 -------------- Type      Plan     AuthID   Connect  CType  Corr ID       Res.
 17MAR-16:58:56 DEADLOCK  AUDIT    BBLLAT5  TSO      TSO    BBLLAT5          2
 17MAR-16:58:45 TIMEOUT   PAYROLL  DMRDLK3  BATCH    BATCH  DMRDLK3          1
 17MAR-16:42:34 TIMEOUT   PAYROLL  DMRTMO3  BATCH    BATCH  DMRTMO3          1
 17MAR-16:37:33 DEADLOCK  AUDIT    BBLLAT5  TSO      TSO    BBLLAT5          2
 17MAR-16:36:53 TIMEOUT   RXDB2    AXCNM11  DB2CALL  CAF    AXCNM11          1
```

Figure 16. Lockout Events (LKEVENT)

   This view shows a chronological list of up to 100 lockout events that have occurred since DB2 startup, sorted with the most current at the top of the screen.

3. Type **SORT** and tab to the **Victim Plan** column to sort these lockout events by plan name to identify the applications for which SQL requests were terminated.

4. Hyperlink on the **Date/Time** field for an event (preferably a deadlock that involves multiple resources).

   The first view shows the resources involved and holder (blocker) and waiter plans.

5. Scroll right to see additional details for both resources at once, or hyperlink on the **Res Seq** field to see all the available details for this conflict.

6. Press **PF3** to return to EZDB2.

   Although you may have analyzed lockout conditions one at a time like this before, the windows-mode views provide additional analysis capabilities. They are available through the other three hyperlinks in the lockouts section of EZDB2.

7. Hyperlink on **Resource Summary** to do an analysis of the resources involved in timeouts or deadlocks, as shown in Figure 17.

Resources Involved

```
17MAR01  17:21:09 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKRESZ===========DB2HC====*========17MAR01==17:21:09====MVDB2====D====2
 --Resource Name--  Total           % Total                          Global
 Database Object    Conflicts       0...50..100   PAGE   ROW INDEX  Conflicts
 DSN8D51A DSN8S51E          5  71.4 ********         5     0     0          2
 DSN8D51A DSN8S51P          2  28.6 ***              0     2     0          2
```

Figure 17. Lockout Resource Summary (LKRESZ)

The first view, LKRESZ, summarizes all conflicts by resource name, usually database and table space. Note that a deadlock with three resources and participants will result in three conflicts, not one, for the purposes of this analysis. With this view, you can easily identify those table spaces involved in the most contention.

8. Hyperlink on a **resource name** showing one or more conflicts to see a breakdown of these conflicts by specific resource, down to a page or row level (LKRESNRZ).

   With this view, hot spots in your tables are immediately visible, as shown in Figure 18.

See Hot Spots in Tables

```
17MAR01  17:22:35 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKRESZ===LKRESNRZ=DB2HC====*========17MAR01==17:22:35====MVDB2====D====1
 --Resource Name-- Resource   Resource  Total           % Total     Global
 Database Object   Number     Type      Conflicts       0...50..100 Conflicts
 DSN8D51A DSN8S51E 0000001200 DATAPAGE          5  71.4 ********            2
```

Figure 18. Lockout Resource Number Summary (LKRESNRZ)

9. Hyperlink on either the **resource name** or the **resource number** to view a list of each lockout event that involved this resource (LKRESD), as shown in Figure 19.

   The events are initially sorted in descending sequence by time, but the SORT command can be used to sort by any column. (If you have forgotten how, type **`HELP SORT`** on the COMMAND line.) This allows you to identify the applications (blocker planname, waiter planname) and users (blocker/waiter Corr ID, Connection, Victim Auth ID) involved quickly.

Each Event for This Resource

```
17MAR01  17:24:34 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKRESZ===LKRESD===DB2HC====*========17MAR01==17:24:34====MVDB2====D====5
 --Resource Name-- Resource   Resource   Time     Lockout  Blocker  Waiter   Gbl
 Database Object   Number     Type     -------- Type     PlanName PlanName Con
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:58:56 DEADLOCK PAYROLL  AUDIT    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:58:45 TIMEOUT  AUDIT    PAYROLL
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:42:34 TIMEOUT  AUDIT    PAYROLL
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:37:33 DEADLOCK PAYROLL  AUDIT    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:36:53 TIMEOUT  RXDB2    RXDB2
```

Figure 19. Lockout Resource Conflict Detail (LKRESD)

Although the solution to locking problems may involve application or table redesign, at least you now know where the problems lie.

10. Press **PF3** until you return to EZDB2 and hyperlink on **Connection Summary** if you suspect that the problem may lie in application scheduling, where applications with incompatible lock usage are running concurrently, as shown in Figure 20.

Application Scheduling Problems

```
17MAR01  17:38:42 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =LKCONZ============DB2HC====*========17MAR01==17:38:41====MVDB2====D====1
 DB2      Victim    Victim   Blocker   Timeouts Deadlocks        % Lockouts
 Target   ConnType  Connect  Connect                            0....50..100
 DB2HC    TSO       TSO      BATCH            0         2   40.0 *****
 DB2HC    BATCH     BATCH    TSO              2         0   40.0 *****
 DB2HC    CAF       DB2CALL  CAF              1         0   20.0 ***
```

Figure 20. Lockout Connection Summary (LKCONZ)

The view LKCONZ summarizes the conflict data to identify, for example, whether batch jobs or utilities are blocking critical CICS or IMS transactions. As in the resource summaries, hyperlinks lead to lists of the exact events with time stamps, so that the critical time periods can be seen at a glance.

11. Press **PF3** until you return to EZDB2 and hyperlink on **Blocker/Waiter Summary** in order to identify incompatible applications that are frequently blocking each other, as shown in Figure 21.

Incompatible Applications

```
17MAR01  17:40:24 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKBWZ============DB2HC====*========17MAR01==17:40:24====MVDB2====D====1
 Blocker  Waiter    Timeout Deadlock        % Conflicts    Global  Participant
 PlanName PlanName  Involv.  Invovl.   .... 0....50...100  Confl.  -Only Count
 AUDIT    PAYROLL         2        0   40.0 *****               0            0
 PAYROLL  AUDIT           0        2   40.0 *****               0            0
 RXDB2    RXDB2           1        0   20.0 ***                 0            0
```

Figure 21. Lockout Blocker/Waiter Summary (LKBWZ)

The view LKBWZ summarizes the conflict data by blocker and waiter plans, so that you can quickly see which applications are causing the most conflicts. The hyperlinks again show all of the lockout events where the selected plan was involved.

12. Press **PF3** until you return to EZDB2.

13. To see current contention, hyperlink to the **Fast Menu** (on the right under Tools And Menus).

    In the Lock Activity section, there are two valuable options:

    - Hyperlink on **User Contention** to see a list of active threads with lock counts (LOCKU). Holding and waiting threads in current conflicts are identified.
    - Hyperlink on **DB/TS Contention** to see a list of resources in contention, showing the lock owner and waiters (LOCKD).

    From both of these displays, you can hyperlink on one conflict to see additional details. The LOCKE display shows a thread with all locked resources and identifies waiter threads per resource.

    Note: LOCKU is also accessible through hyperlinks in several thread views (THDxxx).

Page Set Status and I/O Analysis

The tuning of physical I/O and page set usage in the buffer pools is a critical success factor in DB2. DB2 itself uses many techniques to reduce or defer I/O, but the setup, from DASD volumes to buffer pool allocation and thresholds, all plays a part. To use the options in the Page Sets section of EZDB2 and the Page Set Easy Menu itself to look at data object issues with the focus still on a single DB2:

1. The first thing to review is simply the status of all open page sets. Hyperlink on **Page Set Status** to see a list sorted by object name (database, table space, partition), as shown in Figure 22.

Sort by Object Name

```
17MAR01  16:11:08 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =PSSTAT============DB2H=====*========17MAR01==16:11:08====MVDB2========77
 ------Page Set------- Bfrpl                    %       First   Defr       GBP
 Database Object   Prt  ID    Ty Users Size(K)  Used EXT Volume  WrtQ  ERR Dep
 DB2HWORK DSN4K01  001 BP00   TS     0    7440  99.4   3 BAB310     0   N
 DSNDB01  DBD01    001 BP00   TS     0    1440 100.0   1 BAB310     1   N
 DSNDB01  DSNLLX01 001 BP00   IX     0     288  66.7   1 BAB310     0   N
 DSNDB01  DSNLLX02 001 BP00   IX     0     240  80.0   1 BAB312     0   N
 DSNDB01  DSNLUX01 001 BP00   IX     0      48  33.3   1 BAB320     0   N
 DSNDB01  DSNLUX02 001 BP00   IX     0      48  33.3   1 BAB320     0   N
 DSNDB01  DSNSCT02 001 BP00   IX     0     144  11.1   1 BAB310     0   N
 DSNDB01  DSNSPT01 001 BP00   IX     0     240  40.0   1 BAB312     0   N
 DSNDB01  DSNSPT02 001 BP00   IX     0     432  44.4   1 BAB325     0   N
 DSNDB01  SCT02    001 BP00   TS     0   10080  14.3   1 BAB310     1   N
 DSNDB01  SPT01    001 BP00   TS     0    5760  25.0   1 BAB312     1   N
 DSNDB01  SYSLGRNX 001 BP00   TS     0    1440 100.0   1 BAB310     1   N
 DSNDB01  SYSUTILX 001 BP00   TS     0    1440 100.0   1 BAB320     1   N
 DSNDB06  DSNADH01 001 BP00   IX     0      48  33.3   1 BAB312     0   N
 DSNDB06  DSNAGH01 001 BP00   IX     0      96  16.7   1 BAB314     0   N
 DSNDB06  DSNAPH01 001 BP00   IX     0      96  16.7   1 BAB310     0   N
 DSNDB06  DSNATX01 001 BP00   IX     0     144  11.1   1 BAB312     0   N
 DSNDB06  DSNATX02 001 BP00   IX     0     480  20.0   1 BAB312     0   N
 DSNDB06  DSNATX03 001 BP00   IX     0     432  22.2   1 BAB312     0   N
 DSNDB06  DSNAUH01 001 BP00   IX     0      96  16.7   1 BAB310     0   N
 DSNDB06  DSNDCX01 001 BP00   IX     0    2160  66.7   1 BAB312     0   N
 DSNDB06  DSNDDH01 001 BP00   IX     0      48  33.3   1 BAB310     0   N
 DSNDB06  DSNDDX02 001 BP00   IX     0      48  33.3   1 BAB310     0   N
 DSNDB06  DSNDKX01 001 BP00   IX     0     192  50.0   1 BAB318     0   N
 DSNDB06  DSNDLX01 001 BP00   IX     0      48  33.3   1 BAB312     0   N
 DSNDB06  DSNDPX01 001 BP00   IX     0      96 100.0   1 BAB310     0   N
```

Figure 22. Page Set Status (PSSTAT)

2. Sort on the **EXT** column to identify the data sets with the highest number of extents (a potential performance impact). Type **`SORT D`** and tab to the **EXT** column.

3. If you want to limit the view by selecting only certain page sets, one simple way is to use the WHERE command. It works very much like the SQL WHERE clause. First choose one (or more) column you want to filter the view on. Place the cursor in that column header and press **PF1** to view the field help. Within the help, the element name is identified.

   Now type **`WHERE`** on the COMMAND line. Under Where Condition, type the filters you want in effect.

   For example, to show only those data sets with several extents, type

   `IO_EXT > 5`

   Press **PF3** to return to PSSTAT with the WHERE clause in effect. You can check the filters in effect in any view with the SHOWFILT command.

   Note: Help for any command is available by typing **`HELP commandname`** on the COMMAND line.

   As another example of filtering, to see only catalog tables, type

   `IO_DBTSP = DSNDB06*`

4. Hyperlink on the **Page Set** field to see complete details about the selected page set, including size, volume, buffer pool cache data, and detailed I/O counts and elapsed wait times. You may need to scroll down with **PF8** to see all the data.

5. Press **PF3** to return to PSSTAT.

   Hyperlink on the **Users** column to see the threads currently accessing this page set. Or hyperlink on the **ERR** column to see if a restricted status is in effect for this table space.

6. Press **PF3** to return to EZDB2.

7. One of the most important issues to check periodically is data set placement and volume I/O response times.

   Hyperlink on **Volume I/O Summary** to see the volumes in use for DB2 databases, as shown in Figure 23.

Volumes In Use

```
17MAR01  11:21:48 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSVOLSZ==========DB2H=====*========17MAR01==11:21:48====MVDB2========11
         DB2       Nr.     Sync   I/O Sync Max  Sync Avg                Async
 Volume Target     PSs     I/Os    %  I/O Wait  I/O Wait 0...20...40     I/Os
 BAB309 DB2H         1        9   2.0       35        19 *****              1
 BAB310 DB2H        16      141  31.0      325        24 ********         15
 BAB312 DB2H        21      144  31.6      175        24 ********          43
 BAB314 DB2H         5       25   5.5      667        41 **********+       12
 BAB316 DB2H         4       14   3.1       38        14 ****               0
 BAB318 DB2H         9       50  11.0       73        22 ******            21
 BAB319 DB2H         1        2   0.4       31        17 *****              0
 BAB320 DB2H         5       24   5.3       51        19 *****              6
 BAB321 DB2H         1        3   0.7       32        22 ******             0
 BAB325 DB2H        13       40   8.8       47        20 ******             7
 BAB330 DB2H         1        3   0.7       40        20 *****              1
```

Figure 23. Volume I/O Summary—Session (PSVOLSZ)

8. Type **`SORT D`** and tab to **Sync Avg I/O Wait** to sort the volumes with the highest average delays to the top.

9. These values are based on activity since DB2 startup.

   To see a 2-hour summary of activity for one volume broken down into 15-minute intervals, hyperlink on **Sync I/Os**.

   Press **PF3** to return.

10. Hyperlink on a **volume** to see a list of all page sets on that volume.

    You may want to scroll to the right to see the asynchronous I/Os made for prefetch, since these I/Os have different access characteristics and delay times than do synchronous I/Os.

11. Press **PF3** until you return to EZDB2 and hyperlink on the **Page Set Menu** option to go to EZDPS.

    Hyperlink on any of the **I/O by Page Set** options to look at I/O counts and wait times per page set.

    - Sort on the **Avg I/O Wait** column to identify the highest average delays that can point out DASD response time problems.
    - Sort on **Max I/O Wait** to help identify occasional contention problems that are masked in the averages.

    Note: However, be aware that the maximum is since DB2 startup, not per interval. This does reduce its usefulness.

12. Press **PF3** until you return to EZDPS and hyperlink on **Cache Statistics** to analyze page usage in the buffer pools and hiperpools by page set, as shown in Figure 24.

Cache Statistics

```
17MAR01  16:18:48 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSCACHE===========DB2H=====*========17MAR01==16:18:48====MVDB2========77
 ------Page Set------- Bfrpl     VP       VP        VP      VP     VPTot VPTot
 Database Object   Prt  ID     Current  Maximum  Changed Max Chng  % All   %BP
 DB2HWORK DSN4K01  001 BP00           0        2        0        2    0.0   0.0
 DSNDB01  DBD01    001 BP00           7       23        0        6    4.0   3.5
 DSNDB01  DSNLLX01 001 BP00           9       10        0        6    5.2   4.5
 DSNDB01  DSNLLX02 001 BP00           3        8        0        6    1.7   1.5
 DSNDB01  DSNLUX01 001 BP00           3        4        0        2    1.7   1.5
 DSNDB01  DSNLUX02 001 BP00           2        4        0        2    1.2   1.0
 DSNDB01  DSNSCT02 001 BP00           0        3        0        1    0.0   0.0
 DSNDB01  DSNSPT01 001 BP00           0        3        0        1    0.0   0.0
 DSNDB01  DSNSPT02 001 BP00           0        4        0        1    0.0   0.0
 DSNDB01  SCT02    001 BP00           1        5        0        3    0.6   0.5
 DSNDB01  SPT01    001 BP00           1        5        0        3    0.6   0.5
 DSNDB01  SYSLGRNX 001 BP00           8       13        0        7    4.6   4.0
 DSNDB01  SYSUTILX 001 BP00           3       12        0        5    1.7   1.5
 DSNDB06  DSNADH01 001 BP00           2        3        0        0    1.2   1.0
 DSNDB06  DSNAGH01 001 BP00           2        3        0        0    1.2   1.0
 DSNDB06  DSNAPH01 001 BP00           0        3        0        0    0.0   0.0
 DSNDB06  DSNATX01 001 BP00           2        3        0        2    1.2   1.0
 DSNDB06  DSNATX02 001 BP00           6        6        0        2    3.5   3.0
 DSNDB06  DSNATX03 001 BP00           3        4        0        2    1.7   1.5
 DSNDB06  DSNAUH01 001 BP00           2        3        0        0    1.2   1.0
 DSNDB06  DSNDCX01 001 BP00           7        7        0        4    4.0   3.5
 DSNDB06  DSNDDH01 001 BP00           2        3        0        0    1.2   1.0
 DSNDB06  DSNDDX02 001 BP00           0        3        0        0    0.0   0.0
 DSNDB06  DSNDKX01 001 BP00           2        3        0        1    1.2   1.0
 DSNDB06  DSNDLX01 001 BP00           2        3        0        1    1.2   1.0
 DSNDB06  DSNDPX01 001 BP00           2        3        0        1    1.2   1.0
```

Figure 24. Page Set Cache (PSCACHE)

You may want to sort on the **VP Current** column (descending) to sort those with the highest current storage usage to the top. The VP Changed and VP Max Chng columns identify those page sets with update activity.

13. Press **PF3** until you return to EZDPS and hyperlink on **Summary by Buffer Pool** for assistance in balancing table space allocations to the proper buffer pools, as shown in Figure 25.

Balance Table Space Allocations

```
17MAR2001  16:21:03 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSBPSZ============DB2H=====*========17MAR2001==16:21:01====MVDB2====D====1
 Bfrpl   DB2       Nr.    VP        VP       HP      Total    VP Max  VPMaxChg
  ID    Target     PSs  Current  Changed  Current     I/Os  (1 PSet)  (1 PSet)
 BP00   DB2H        77      173        0        0     1341        23        15
 BP02   DB2H        23       12        3        0      522        84         8
```

Figure 25. Buffer Pool Page Set Summary—Session (PSBPSZ)

The view PSBPSZ gives you a quick overview of how all the buffer pools are being used.

14. Hyperlink on Bfrpl ID to see a list of all page sets allocated to that pool (PSBPS). Sort on the VP Current column (descending) to sort those with the highest current storage usage to the top.

    The VP Changed and VP Max Chng columns identify those page sets with update activity.

15. Press **PF3** until you return to PSBPSZ. Hyperlink on **VP Current** for a 2-hour history.

16. Press **PF3** until you return to EZDB2.

Use Monitors to Isolate Problems

Monitors sample key measurements over time and save short-term history. When thresholds are specified, the measured values are compared and automatic warnings generated.

A default set of monitors defined in BBPARM member BLKDMRW is automatically started. This set can be tailored for each DB2 system with different monitors or different thresholds.

To view the active monitors:

1. From the Primary Option Menu, select the **MONITORS** option.

   ```
   OPTION ===> 3            (Active Timer Requests)
   ```

   All ***active*** monitors are listed here. The current measurement values are shown and plotted compared to the thresholds. The W in the middle marks the warning threshold values. All monitors with acceptable values remain on the left side of the W. Those in warning status extend to the right and are highlighted, as shown in Figure 26.

Warning Status

```
 BMC Software --------------- ACTIVE TIMER REQUESTS ----------  PERFORMANCE MGMT
 COMMAND ===>                                                  TGT ===> DB2G
                                  INPUT    INTVL ==> 3       TIME --  10:52:10
 COMMANDS: SM (START MONITORS), SORT, AREA, X ON|OFF, DM (DMON), DW (DWARN)
 LC CMDS: S (SELECT), W (SHOW),      M(MODIFY),
          P (PURGE),  R (REPLICATE), H (HELP), Z (STOP)                    >>>
LC   SERV  PARM     TITLE                   CURRENT  WVAL |-8-6-4-2-0+2+4+6+8+|
     CONUT TSO      CONNECTION % UTILIZATION     35    80 |<<<<<<<< W         |
     CONUT BATCH    CONNECTION % UTILIZATION      2    80 |**       W         |
     CONUT DBAT     CONNECTION % UTILIZATION     18    80 |>>>>     W         |
     THDUT          THREAD % UTILIZATION         50    85 |<<<<<<<  W         |
     THDQD CICS     QUEUED THREADS                0    NZ |         W         |
     THDWT          CREATE THREAD WAITED          0     5 |         W         |
     EDMPL          EDM POOL % UTILIZATION       89    85 |>>>>>>>>>W>>>      |
     BPUTL BP0      BFR POOL % UTILIZATION       76    85 |******** W         |
     BPUSE BP0      BFR POOL % IN USE            33    85 |***      W         |
     RIDUT          RID POOL % UTILIZATION       45    85 |<<<<<    W         |
     LOGUT          ACTIVE LOG % UTILIZATION     53    85 |>>>>>>   W         |
     CSAP           CSA % UTILIZATION            95    80 |>>>>>>>>>W>>>>>>   |
     ECSAP          ECSA % UTILIZATION           79    80 |******** W         |
     DSUTL          OPEN DB DATASET % UTIL       24    85 |**       W         |
     DSOPN          DB DATA SETS OPEN            38    60 |>>>>>    W         |
     DB2DP DBAS     DEMAND PAGING               600  1800 |<<<      W         |
     LTIME          LOCK TIMEOUT FAILURES         1     5 |**       W         |
     LDEAD          LOCK DEADLOCK FAILURES        0    NZ |         W         |
     EDMLD DBD      AVG EDM REQUESTS/LOAD         0   140 |         W         |
     RWP            READS WITH PAGING             0    NZ |         W         |
     WWP            WRITES WITH PAGING            0    NZ |         W         |
     GETPG BP0      GETPAGE REQUESTS           1144  1000 |*********W**       |
```

Figure 26. Active Timer Requests Application

2. Type **X ON** on the COMMAND line to view only those monitors in exception status.

   We'll investigate exceptions more thoroughly later.

3. To find out how to start a monitor (and generate an exception to view):

   ```
   COMMAND ===> SM          (Start Monitor)
   ```

   This application displays a list of all available monitor services. (SM is an ***application transfer*** command that saves your current position and transfers you to another application. You can type a transfer command in any COMMAND line or SERV field.)

Start a Monitor

Monitors look at either resources/system activity (resource monitors) or at workload activity (workload monitors). One workload monitor can be started multiple times to look at different workloads to help isolate specific workload-related problems. Some resource monitors also have parameters to support multiple requests—for example, buffer pool number.

There are many available monitors. You can scroll through the list with PF7/8, sort on any of the columns, or select only those monitors for the area in which you are interested.

To practice starting a monitor:

1. Type **AREA WKLD** on the COMMAND line.

   All workload monitor names start with **#** (for a count) or with an **@** (for an average).

2. Type **S** in the line command column next to #SQLM to select a workload monitor.

   By selecting #SQLM, you can view some immediate activity because this service measures the number of DML statements issued.

   This takes you to the data entry panel, as shown in Figure 27.

Using Defaults

```
BMC Software --------- START DB2 WORKLOAD MONITOR REQUEST ---  PERFORMANCE MGMT
COMMAND ===>                                                  TGT ===> DB2G

                      #SQLM - DATA MANIPULATIVE SQL

PARM     ==>                              (Workload Monitor Identifier)
INTERVAL ==> 00:01:00 START ==>           STOP ==>                 QIS ==> YES
WVAL     ==>          WMSG  ==>           WLIM ==> 10  WIF ==> 1   WIN ==> 1
TITLE    ==>                              (Title)
RST      ==> HOT                          (Restart Option: HOT,COLD,PUR,QIS)
PLOTMAX  ==>                              (Maximum PLOT X-Axis Value)
RANGES   ==>                              (1-4 Range Distr. Upper Limits)
LOG      ==>                              (NO,ATSTOP,ATPD,ATINTVL,ATWARN)
Specify Selection Criteria:
   ICHECK   ==> NO                        (Check elapsed versus Interval time)
   CONNTYPE ==>                           (TSO, IMS, CICS, BATCH, CAF or blank)
   DB2PLAN  ==>
   DB2AUTH  ==>
   DB2CONN  ==>
   DB2CORR  ==>
   DB2LOC   ==>
```

Figure 27. Start DB2 Workload Monitor Data Entry Panel

3. Define optional workload monitor data collection parameters on the data entry panel using mostly defaults.

   a. `PARM ==>` **`id`**

      You can specify any name as an ID if you want several requests for this monitor to look at different workloads.

   b. `INTERVAL ==>`

      Use the default (00:01:00) of one minute data collection intervals.

   c. `START ==>`

      Use the default to start at the next even minute, or type a future time in the format of hh:mm:ss.

      Note: The monitors are synchronized to the even minute to make it easier for you to compare the history values they collect.

   d. `STOP ==>`

      Use the default of no stop time, or type a time at which you want the monitor to stop in the format of hh:mm:ss, or the number of intervals (minutes).

   e. `WVAL ==>` **`warning threshold value`** `Maximum (n) or Minimum (<n)`

      A warning message is issued automatically when a sampling exceeds the monitor threshold. Type a low value so you can see a warning. For example, if you expect 100 statements in a minute, type 50. It can be changed to a more appropriate value later.

   f. `WMSG ==>`

      If left blank, a warning message is sent to the Journal log when sampling exceeds the monitor threshold (also triggers AutoOPERATOR EXECs). Current warnings are shown on DB2EX. Specify **`WTO`** to also send a message to the MVS console, or a **`TSO id`** to send a message to that user.

   g. Optional fields: (For this exercise, accept the defaults)

WLIM	Limit number of warnings sent
WIF	Wait n intervals before issuing a warning
WIN	Wait n intervals before sending nth warning
RST	Monitor reaction if DB2 stops and is restarted
PLOTMAX	Specifies maximum value of X Axis on monitor plot display
RANGES	Limits for range distribution statistics on plot display
LOG	A hardcopy plot is recorded in the BBI-SS PAS Image log

4. Specify workload selection criteria.

   `DB2CONN ==>` **`name,name,name`**

   Optional. Type one or more names, where name can be TSO, BATCH, DB2CALL, an IMSID, or a CICS jobname. Leave blank for total workload.

5. Press **Enter** to start the monitor and return to the list of monitors.

6. Access the Active Timer Requests (AT) display to make more requests.

```
COMMAND===> AT     (transfer to Option 3 - MONITORS)
 or    ===> =3     (a quick jump without saving a return path)
```

7. Type **R** in the line command column next to an active workload monitor to replicate an active monitor request.

   This replicates the request parameters.

8. Make another request by typing a unique ID in the PARM field and specifying different selection criteria. Press **PF1** (HELP) for an explanation of the values that can be specified, as shown in Figure 28.

Getting Help

```
BMC Software --------- SET KEYWORDS - WORKLOAD SELECTION CRITERIA ---- TUTORIAL


The following keywords can be used to qualify data collection by a workload
monitor:

CONNTYPE   TSO|IMS|CICS|BATCH|CAF|blank
           IMSMPP|IMSBMP|IMSTBMP|IMSCTL|DLI|SYSSERV|APLSERV|UTIL (DMR 3.1 and
           above)
            These keywords allow workload selection by connection type.
            Blank is the default, which selects all the connection types.

ICHECK     YES|NO
            If YES is specified, the transaction is discarded if the elapsed
            time is greater than the requested interval time.  NO is the
            default.

            Data is only available at transaction termination time.  YES
            prevents long running transactions from skewing the interval
            statistics.

                                                        continued next page...
```

Figure 28. Sample Help Panel

9. Press **Enter** to start the monitor and return to Active Timer Requests.
10. Move the cursor to the COMMAND line and continue to press **Enter** until the new monitors show an ACTIVE status and current measurement values. (Remember, they were synchronized to start at an even minute.)
11. Check that at least one monitor is in warning status (line highlighted).
12. Use the Modify line command to view the monitor options in effect and to modify any that are preceded by an arrow.

    ```
    LC   (Line Command)
     M   (for Modify)
    ```

    Choose an active monitor and change its threshold value.

    ```
    WVAL ==> n     (Maximum)
    WVAL ==> <n    (Minimum)
    ```

    If you did not start this monitor, you need special authorization to modify or purge it.

13. Press **PF3** to return to the AT panel.

    Look at how the graph of the current value compared to the new threshold has changed.

    Note: To stop a monitor, use the **Z** line command.

You now know how to start and modify monitors. The next dialog shows you how to look at the data.

Review Critical Problems

To review critical problems, including those just identified by monitors, return to the **DB2EX** analyzer service.

- Type

```
 OPTION  ===> 2        (from the Primary Option Menu)
COMMAND  ===> AN       (transfer to ANALYZERS)
   or    ===> =2       (jump to Option 2)
```

  Then type **S** in the line command column next to the DB2EX service.

- An even quicker way, if you remember the name of the display you want, is

```
COMMAND ===> EXEC DB2EX
```

  Note: If you want a display with one or more parameters, type **EXEC serv parm1,parm2** on the COMMAND line. For example: **EXEC BFRPL BP0**.

- In a service display, just overtype SERV ===> **DB2EX** and clear any PARM values.

Note: To print any display while you are looking at it, use **PF4** for screen print. To print a series of displays while you are viewing them, specify **LOG=Y** in line 2.

Exceptions

To review the information on the exception panel:

1. Move the cursor to a message and press **Enter**.

   A detailed explanation of the message is shown by the MESSAGES general service.

2. Press **PF3** to return to the DB2EX display.

   The exception display lists the time the exception occurred and the severity (S for severe, W for warning, I for informational, M for monitor messages). You can enter the severity code in the PARM field to select the messages for display by severity level, as shown in Figure 29.

Severe Messages

```
BMC Software --------------      DB2 EXCEPTIONS      ----------PERFORMANCE MGMT
SERV ===> DB2EX            RUNNING 11:25:05 INTVL =>  3  LOG => N  TGT ==> DB2G
PARM ===> S                 EXCEPTIONS DISPLAYED   1 -  10 of  10 SCROLL=> CSR
EXPAND:  MON(DSYS), LINESEL(MSG)

TIME      LEV  MSGNO            EXCEPTION

11:24:00   S DZ1090S FINAL ACTIVE LOG DATASET 75% FULL
11:24:00   S DZ1110S BSDS REDUCED TO SINGLE MODE
11:23:00   S DZ1020S IMS TASK(S) QUEUED FOR THREAD(S)
11:20:00   S DZ1050S BP(0) DM CRITICAL THRESHOLD REACHED
```

Figure 29. DB2 Exceptions Panel

Note: You have already learned how to change monitor thresholds. The background exception messages (S, W, I) are user-modifiable for each DB2 system independently in BBPARM member DMRBEX00. This is also where you specify thresholds for runaway query exceptions per connection type (TSO, CICS, and so on). These exceptions can be triggered based on CPU percent, GETPAGEs, CPU total, elapsed time, or updates per commit.

Warning Overview

To return to the list of active monitors (Active Timer Requests - AT) for an overview of important system measurements:

1. Type

   ```
   SERV ==> =3          (transfer to Option 3 - MONITORS)
   ```

   Where warning thresholds are specified, the current value is plotted compared to the threshold (W marker). Arrow signs indicate an increasing (>) or decreasing (<) trend. (Yellow if increasing.)

   If the threshold is exceeded, that monitor line is highlighted (red) and a corresponding warning message is shown in the Exceptions display (DB2EX).

Usually, a standard set of monitors is started automatically to collect data whenever the target DB2 is up. Look at all monitors already in warning status or approaching it. For example, if both LOCK TIMEOUT FAILURES and THREAD PERCENT UTILIZATION are high, as shown in Figure 30, the lock contentions are probably caused by a high level of user activity. If only the timeouts are in warning status, a single batch job may be holding too many locks (analyzer LOCKU shows details).

Lock Contention ==>

==>

```
 BMC Software --------------- ACTIVE TIMER REQUESTS ----------  PERFORMANCE MGMT
 COMMAND ===>                                                  TGT ===> DB2G
                                    INPUT    INTVL ==> 3      TIME --  10:52:10
 COMMANDS: SM (START MONITORS), SORT, AREA, X ON|OFF, DM (DMON), DW (DWARN)
 LC CMDS: S (SELECT), W (SHOW),      M(MODIFY),
          P (PURGE),  R (REPLICATE), H (HELP), Z (STOP)                    >>>
LC   SERV  PARM     TITLE                   CURRENT  WVAL |-8-6-4-2-0+2+4+6+8+|
     CONUT TSO      CONNECTION % UTILIZATION     35    80 |<<<<<<<< W          |
     CONUT BATCH    CONNECTION % UTILIZATION      2    80 |**       W          |
     CONUT DBAT     CONNECTION % UTILIZATION     18    80 |>>>>     W          |
     THDUT          THREAD % UTILIZATION         89    85 |>>>>>>>>>W>>>       |
     THDQD CICS     QUEUED THREADS                0    NZ |         W          |
     THDWT          CREATE THREAD WAITED          0     5 |         W          |
     EDMPL          EDM POOL % UTILIZATION       50    85 |<<<<<<<  W          |
     BPUTL BP0      BFR POOL % UTILIZATION       76    85 |******** W          |
     BPUSE BP0      BFR POOL % IN USE            33    85 |***      W          |
     RIDUT          RID POOL % UTILIZATION       45    85 |<<<<<    W          |
     LOGUT          ACTIVE LOG % UTILIZATION     53    85 |>>>>>>   W          |
     CSAP           CSA % UTILIZATION            72    80 |>>>>>>>> W          |
     ECSAP          ECSA % UTILIZATION           80    80 |*********W          |
     DSUTL          OPEN DB DATASET % UTIL       24    85 |**       W          |
     DSOPN          DB DATA SETS OPEN            38    60 |>>>>>    W          |
     DB2DP DBAS     DEMAND PAGING               600  1800 |<<<      W          |
     LTIME          LOCK TIMEOUT FAILURES         8    NZ |*********W******** |
     LDEAD          LOCK DEADLOCK FAILURES        0    NZ |         W          |
     EDMLD DBD      AVG EDM REQUESTS/LOAD         0   140 |         W          |
     RWP            READS WITH PAGING             0    NZ |         W          |
     WWP            WRITES WITH PAGING            0    NZ |         W          |
```

Figure 30. Active Timer Requests Application

More Detailed Information

To view more detailed information:

1. If you are interested in one specific area, such as buffer pools, you can narrow down the display to show only the related monitors.

   ```
   COMMAND ===> AREA BUFR      (enter AREA alone to see them all again)
   ```

   This makes it easier to concentrate on just the buffer information; for example, to compare the GETPAGE REQUESTS to READ I/O and PREFETCH READ I/O.

2. If you don't see the data you want, you can use the same technique to review the other available monitors for buffer pool information.

   ```
   COMMAND ===> SM          (Option 2 - START MONITORS, with stacking)

   COMMAND =>   AREA BUFR
   ```

   You could start additional buffer pool monitors now, just the way you did for #SQLM.

3. Press **PF3** to return to the list of active monitors.

4. Use the Select line command to view the history collected by a monitor.

   ```
   LC   (Line Command)
    S   (for Select)
   ```

   Choose an active monitor that is showing non-zero for the current value. If the DB2 you are monitoring is very active, there should be several, including the #SQLM monitor you just started. If not, choose one of the MVS-related monitors such as CSAP, CSA Percent Utilization.

   This standard **PLOT** display, shown in Figure 31, is used to show the latest 10 values measured by any monitor. For further trending information, the averages for the total monitoring period and the last 2 periods (10 samples each) are also shown. The threshold value is indicated with a W in the graph. Note the **MAXimum** value ever measured and the time it occurred (MAX AT). Rate per second calculations (in this example, paging rates) are shown at the right.

Rates/Second

Maximum Value

```
BMC Software --------------    MONITOR HISTORY      -----------PERFORMANCE MGMT
SERV ==> PLOT            INPUT    12:26:34  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> DB2DP                                                   SCROLL=> CSR
TOTAL      96,120       DB2DP DEMAND PAGING                      START  11:58:00
   28 SAMPLES      PERIOD  00:10:00   INTERVAL  00:01:00      ELAPSED  00:28:00
AVG/INTVL--.----+----I----+----I----+----I----+----I----+----I----+----I  --- AVG/SEC ---
  TOTAL    .************************          W            .      57.21
  PREV PD  .*********************************  W            .      74.99
  CURR PD  .******************                 W            .      42.62
INTERVALS--.----+----I----+----I----+----I----+----I----+----I----+----I
 12:17:00  .*********                          W            .      19.17
 12:18:00->.*******                           W            .      15.78
 12:19:00  .***********************************W****       .      91.15
 12:20:00  .***********************************W************     109.57
 12:21:00  .**********                         W            .      22.97
 12:22:00  .*************                      W            .      29.08
 12:23:00  .**********                         W            .      21.55
 12:24:00  .**************                     W            .      30.32
 12:25:00  .********************             W            .      45.33
 12:26:00  .********************************* W            .      75.97
           .----+----I----+----I----+----I----+----I----+----I----+----I
           0      1320      2640      3960      5280      6600 MAX AT 12:01:00
MAX=====>110.05
```

Figure 31. Sample PLOT Display

5. Press **PF3** to return to the list of active monitors.
6. Restrict the display to monitor exceptions only.

   ```
   COMMAND ===> X ON
   ```

7. Press **PF6** to start automatic refresh mode, or type

   ```
   COMMAND ===> GO
   ```

   Check to see that the word **INPUT** on line 3 has been replaced by **RUNNING**.

   You can start automatic refresh whenever you want to watch for problems or events without continually pressing **Enter**.

8. Press **ATTN** to stop refresh and enable command entry.
9. Return to the full display.

   ```
   COMMAND ===> X OFF
   ```

10. Change to some other installed MAINVIEW product.

    ```
    COMMAND ===> product name
    ```

    IMS, CICS, DB2, AO, CAO, IAO, and MAO are valid names.

    This saves your current place and presents the Primary Option Menu of that product. You can even stack copies of MAINVIEW for DB2 by typing **DB2.** This can be useful when you must look at another system or product (for example, to answer a user question about production), but you don’t want to lose your place.

11. Return to your original place (Active Timer Requests).

    ```
    COMMAND ===> =X
    ```

    You can also press **PF3** in the stacked environment until you exit from its Primary Option Menu.

Windows-Mode Monitor Views

All of the monitor data you have just seen in full-screen displays is also available in windows mode. Both the EZDB2 and EZDSSI Easy Menus have several hyperlinks to monitor views, as shown in Figure 32.

Monitor Views ==>

```
17MAR01  16:32:36 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =EZDSSI==========(ALL======*=======)17MAR01==16:37:22====MVDB2====D====1
                            DB2 SSI Easy Menu
   Status                                              Threads
  . Overview               +----------------------+  . Current Threads
  . Exceptions             |   Place cursor on    |  . DB2 Summary
  > Buffer Pools           |    menu item and     |  . Attach Summary
  > Status Menu            |     press ENTER      |  . Connect Summary
                           +----------------------+  . Plan Summary

   Data Sharing              Monitors
  . GBP Group Status        . In Warning                Tools And Menus
  . GBP Group Activity      . Summary By Area         . Set SSI Context
  . Global Lock Stats       . Active                  > Easy Menu
  . Global Lockouts         . Workload Objectives     > MAIN Menu
  . Volume I/Os (SSI)                                 > Tuning Wizards
  > Page Set Menu                                     . Return...
```

Figure 32. DB2 SSI Easy Menu (EZDSSI)

The monitor views are able to provide an SSI perspective on monitor status, as well as the details for one DB2. To see these views:

1. Check to be sure that you have an SSI context in effect. If not, type

   `CON ALL`

2. Hyperlink on **Monitors—In Warning** to see a view of all monitors in warning status in that SSI context, as shown in Figure 33.

See All Warnings

```
17MAR01  11:59:40 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =DMWARN===========DB2HC====*========17MAR01==11:59:39====MVDB2====D====1
CMD Serv  Parm             % Warning    Curr     Warn     Area Target
--- ----- --------       0.....50...100 Value--- Value--- ---- --------
    @ELTM ALLWORK  319.3 *************+     3.19     1.00 WKLD DB2HC
    CSAP           136.0 *************+    68.00    50.00 DMVS DB2HC
```

Figure 33. Monitors in Warning (DMWARN)

3. Hyperlink on the **Serv** column to see the equivalent of the full-screen PLOT display, as shown in Figure 34.

   Notice that the time intervals here have the most recent times at the top. Each plot view has a hyperlink to a related full-screen display.

Monitor Plot in Windows Mode

```
17MAR01  12:01:55 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                    1                          SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =DMWARN===D@ELTM===DB2HC====*========17MAR01==12:00:58====MVDB2====D====1
   >>USERS   |.....|......|  Elapsed   Events Parm..... ALLWORK
   12:00:30                   66.108      3  Appl..... SAMPLE
   11:59:00                    0.331      6  Warning..     1.00
   11:57:30                    0.000      0  Max/Min..  Maximum
   11:56:00                    0.000      0   Value...  2304.72
   11:54:30                    0.000      0   Time.... 11:48:30
   11:53:00                    0.000      0  Graph Max  2304.72
   11:51:30                   16.022      1  Target... DB2HC
   11:50:00                    0.000      0  Descript. Sample DB2 Workload
   11:48:30  **************  2304.721      2
   11:47:00                    2.330      1  Samples..       69
             |.....|......|  Elapsed   Events Period... 00:15:00
   Total     *                86.226     69  Samp Int. 00:01:30
   Prev Pd                     0.000      0  Start.... 10:17:00
   Curr Pd                     3.361     28  Elapsed.. 01:43:30
```

Figure 34. Sample Plot View

4. Press **PF3** twice to return to EZDSSI.

5. Hyperlink on **Monitors—Summary by Area** to see a summary of active monitors and their warning status by target and area, as shown in Figure 35.

See Monitors by Target and Area

```
17MAR01  18:05:18 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =DMAREAZ==========(ALL======*=======)17MAR01==18:05:16====MVDB2========10
CMD                     Number  Number            Average Maximum Number
--- Target   Area     Monitors in Warn 0.......10 Warning Warning Active
    DB2GC    DMVS            2       0               74.1    95.2      2
    DB2HC    EDM             2       0               40.0    40.0      2
    DB2HC    DMVS            5       1 *             38.4   136.0      5
    DB2HC    LOG             8       0               11.8    23.5      8
    DB2HC    LOCK            8       0                1.6     8.0      8
    DB2HC    DSYS            4       0                1.5     2.4      4
    DB2HC    USER           22       0                0.8     3.7     22
    DB2HC    DDF             3       0                                 3
    DB2HC    WKLD            6       1 *           319.3   319.3      6
    DB2HC    BUFR           24       0                                24
```

Figure 35. Monitor Summary by Area (DMAREAZ)

   The hyperlinks provide a list of the monitors.

6. Press **PF3** to return to EZDSSI.

7. Hyperlink on **Monitors—Active** to see a summary of active monitors per target DB2.

   Additional views are available to show the monitor data from a realtime (DMONR) or session (DMONS) perspective, while DMONC shows all time perspectives in one view.

8. Press **PF3** to return to EZDSSI.

Workload Objective Views

Special workload monitors are started automatically for you to provide service-level monitoring of response time per workload.

Several default workloads have been predefined for transaction and query connections to DB2, based on connection type. Please refer to Volume 1 of the *MAINVIEW for DB2 User Guide* if you want to add workloads or modify the response time objectives of the existing workloads.

To see if you are meeting your response time goals for the defined workloads:

1. From EZDSSI, hyperlink on **Monitors—Workload Objectives** to review workload objectives, as shown in Figure 36.

Are You Meeting Your Goals?

```
17MAR01  11:59:40 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =DOBJ==============(ALL=====*=======)17MAR01==14:49:33====MVDB2====D====1
CMD Workload       % <= Resp Goal Resp  Goal Avg     Tran  Composite Target
--- Name----       0.....50...100 Goal-    % Resp--- Count Workload- --------
    ALLWORK   95.6 *************   1.00   95   0.843   125 SAMPLE    DB2H
    ALLWORK   66.7 *********       1.00   95   1.428   167 SAMPLE    DB1H
    CAF      100.0 **************  5.00   90   3.221     2 DB2SAMP   DB1H
    CICS     100.0 **************  1.00   95   0.543   160 DB2SAMP   DB1H
    DBATDB2   00.0                 5.00   90   0.000     0 DB2SAMP   DB1H
    DBATDRDA  00.0                 5.00   90   0.000     0 DB2SAMP   DB1H
    IMSMPP    00.0                 1.00   95   0.000     0 DB2SAMP   DB1H
    TSO       52.1 *******         5.00   90   7.331     5 DB2SAMP   DB1H
```

Figure 36. Objectives Review (DOBJ)

The graph shows what percentage of all threads in that workload have met the response time goal.

Audit Trail

Look for Problems

To view an audit trail of problems throughout the day:

1. Transfer to the Log Display general service (Option L).

   ```
   COMMAND ==> LOG
   ```

   Or press **PF5**.

   All ***MAINVIEW for DB2 messages*** are shown chronologically, as shown in Figure 37.

```
BMC Software -------------------- Log Display -------------- General services
COMMAND ===>                                                 TGT ===> DB2G
LINE=      12,340  LOG= #1   STATUS= INPUT    TIME= 17:51:38 INTV===> 3
12:11:00  DS0560W  (04) 12:11:00 ECSA % UTILIZATION(TOTAL) = 71  (>70) ********
12:12:00  DS0560W  (05) 12:12:00 ECSA % UTILIZATION(TOTAL) = 71  (>70) ********
12:12:55  XS6311I  BBI/SESSION FOR -CPS17   - TERMINATED
12:13:00  DS0560W  (06) 12:13:00 ECSA % UTILIZATION(TOTAL) = 71  (>70) ********
12:14:00  DS0560W  (07) 12:14:00 ECSA % UTILIZATION(TOTAL) = 71  (>70) ********
12:15:00  DS0560W  (08) 12:15:00 ECSA % UTILIZATION(TOTAL) = 72  (>70) ********
12:16:00  DS0560W  (09) 12:16:00 ECSA % UTILIZATION(TOTAL) = 71  (>70) ********
12:17:00  DS0560W  (10) 12:17:00 ECSA % UTILIZATION(TOTAL) = 71  (>70) ********
12:22:11  XS6304I  BBI/SESSION FOR -LAA1    - TO -D31X- INITIATED
13:12:00  DS0561I   13:12:00 ECSA % UTILIZATION(TOTAL) NO LONGER > 70
13:28:48  DSNW131I - STOP TRACE SUCCESSFUL FOR TRACE NUMBER(S) 05
13:28:49  DSN9022I - DSNWVCM1 '-STOP TRACE' NORMAL COMPLETION
13:53:02  DS0560W  (01) 13:53:00 ECSA % UTILIZATION(TOTAL) = 72  (>70) ********
13:54:00  DS0560W  (02) 13:54:00 ECSA % UTILIZATION(TOTAL) = 74  (>70) ********
13:55:01  DS0560W  (03) 13:55:00 ECSA % UTILIZATION(TOTAL) = 74  (>70) ********
13:56:00  DS0560W  (04) 13:56:00 ECSA % UTILIZATION(TOTAL) = 74  (>70) ********
13:57:01  DS0560W  (05) 13:57:00 ECSA % UTILIZATION(TOTAL) = 74  (>70) ********
13:58:00  DS0560W  (06) 13:58:00 ECSA % UTILIZATION(TOTAL) = 74  (>70) ********
13:58:12  DSN3201I + ABNORMAL EOT IN PROGRESS FOR USER=LGS11
13:58:12  CONNECTION-ID=DB2CALL CORRELATION-ID=LGS11
```

Figure 37. Sample Log Display

   You also can request an online audit trail of all ***DB2 system messages*** by specifying LOG=YES per target DB2 in the DMRBEX00 member of the BBPARM data set.

2. Check for exceptions that occurred in a specific period (Locate Time).

   ```
   COMMAND ==> T 1130
   ```

3. FIND a specific problem (and press **PF5** for RFIND). For example:

   ```
   COMMAND ==>  FIND DW0200W (#SQLM monitor warning)
   COMMAND ==>  FIND DSNT375 (DB2 deadlock messages)
   COMMAND ==>  FIND DZ0630W (Runaway TSO query)
   COMMAND ==>  FIND RUNAWAY (Runaway thread from any connection)
   COMMAND ==>  FIND DW0     (All workload monitor warnings)
   ```

4. Scroll to the left with **PF10** to see the origin of the messages.

   This value can be used to select a subset of the messages in the Journal log.

5. Type **PROFILE** on the COMMAND line to access the Enhanced Journal Facility, as shown in Figure 38.

Select Messages from One Target

```
BMC Software -------------------- Log Display -------------- General services
COMMAND ===>
                                                             Date --- 01/03/16
 Included Origins            Excluded Origins                Time --- 12:41:32

  DB2G____                      ________
  ________                      ________
  ________                      ________
  ________                      ________
  ________                      ________
  ________                      ________




     Press END to SAVE Profile and return to application
           CANCEL to discard changes
```

Figure 38. Enhanced Journal Facility

6. Type your **DB2 target name** (see the TGT field) in the Included Origins column. Return to the Log Display to view the messages only from that DB2.

7. Issue the **PROFILE** command again and specify **&TARGET** in the Included Origins column to automatically select the messages from the current target DB2 subsystem. Also specify the **BBI-SS PAS id** to include MAINVIEW for DB2 messages.

Issue DB2 Commands

If you have the proper authorization in MAINVIEW for DB2 (this is not DB2 authorization), you also can issue DB2 commands from the COMMAND line:

1. Submit a DISPLAY THREAD command.

   ```
   COMMAND ==> -DIS THD(*)
   ```

   The command is automatically routed to the DB2 system shown in the target field. You do not need to know the subsystem recognition character (SSRC) for each DB2.

   The command response is shown in Figure 39.

DISPLAY THREAD Command Response

```
BMC Software -------------------- Log Display -------------- General services
COMMAND ===>                                                TGT ===> DB2G
LINE=      30,270  LOG= #1   STATUS= INPUT    TIME= 16:01:28 INTV===> 3
16:00:20  -DIS THD(*)
16:00:20  DSNV401I - DISPLAY THREAD REPORT FOLLOWS -
16:00:20  DSNV402I - ACTIVE THREADS -
16:00:20  NAME     ST A   REQ ID           AUTHID   PLAN     ASID
16:00:20  DB2CALL  T  *   143 DB231        D31X              0068
16:00:20  DB2CALL  T       30 OLTF         OLTF              00CF
16:00:20  X18H     N      300 0001DSN8IC0  PDRIVER           010D
16:00:20  X18H     N        2              BABUSER           00FC
16:00:20  CICSCN3  N        3              BABUSER           0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  CICSCN3  N        0                                0117
16:00:20  DISPLAY ACTIVE REPORT COMPLETE
16:00:20  DSN9022I - DSNVDT '-DIS THD' NORMAL COMPLETION
```

Figure 39. Log Display

Chapter 3. Monitoring a DB2 Data Sharing Group

Monitoring DB2 data sharing increases the complexity of both the environment and the number of tuning *knobs* that needs to be analyzed and optimized.

The first key requirement is to be able to focus on the level of data that is required to understand how the data sharing group is performing, or to solve a particular problem. Since a data sharing group consists of multiple DB2 members, and these members work together and share resources, viewing each DB2 individually is no longer adequate.

These scenarios show you how to look at all the members concurrently so you can easily compare activity and resource usage across the group, as well as access summarized data for the whole group, such as group buffer pool activity, total database I/O to the shared tables, or global lock contention. Of course, you will still drill down to an individual DB2 member for details as needed.

In this practice session, you

1. Define a Single System Image (SSI) context for the data sharing group(s).
2. Check on current group activity.
3. Look at page set considerations.
4. Analyze global lock contention.
5. Tune group buffer pools.

Note: This practice session takes approximately one hour to complete.

Define the Group Context

Start this scenario at the EZDSSI menu, described on page 8.

The first thing you need to do is make sure that you have a Single System Image (SSI) context defined for the data sharing group(s) you want to look at:

1. Select the **Set SSI Context** hyperlink (first option under Tools And Menus).

   This presents a view of all the defined SSI contexts for MVDB2, as shown in Figure 40.

All Defined MVDB2 SSI Contexts

```
17MAR2001  16:17:22 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =CONASEL==========SYSD=====*========17MAR2001==16:17:21====PLEXMGR==D====4
CMD SSI      Product  Description                              Num  Num
--- Context- -------- ------------                             Targ Act
    ALL      MVDB2    DB2 SSI context                             3    3
    ALLDB2   MVDB2    All DB2 Systems                             9    9
    DBGHC    MVDB2    DB2 5.1 Data Sharing Group                  2    2
```

Figure 40. SSI Context Selection List (CONASEL)

2. If you do have a context defined for the data sharing group you want to monitor, all you need to do is hyperlink on the context name. This returns you to EZDSSI with the new context in effect.

   If you don't have a context defined, you should define one now. (Even if you have a context defined, you may want to browse a little.) On the COMMAND line, type

   `CONACTZ`

   This view lists all SSI contexts (as known by your CAS and any connected CASs). Your CASID is shown on the window information line.

   If you have multiple MAINVIEW products installed, here you see one of the most powerful features of SSI—that the same context can be defined for several different MAINVIEW products. Obviously, since each product may look at different target types, the selection criteria can vary.

3. Select the default context of **ALL** for **MVDB2** to hyperlink to the CONACT view.

   Now you see each of the defined DB2 target subsystems, as shown in Figure 41.

All Defined DB2 Subsystems

```
17MAR2001  11:05:15 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =CONACTZ==CONACT===SYSD=====*========17MAR2001==11:02:43====PLEXMGR==D====3
CMD SSI      Product  Target   Status           Description
--- Context- -------- Context- of_Target---     ------------
    ALL      MVDB2    DB0HC    ACTIVE           MAINVIEW for DB2
    ALL      MVDB2    DB1HC    ACTIVE           MAINVIEW for DB2
    ALL      MVDB2    DB2HC    ACTIVE           MAINVIEW for DB2
```

Figure 41. SSI Context Activity Manager (CONACT)

4. Type **CONDEF** on the COMMAND line to access the context definition dialog.
5. Browse an example of a context definition.

   If a data sharing group context already exists, hyperlink on the SSI context name to see how the target filters were defined. If you don't see the group, select any other context. (You will at least see the default context of ALL.)
6. Press **PF3** to return to CONDEF.
7. Type **EDIT** on the COMMAND line to obtain an edit lock.
8. Type **ADD** on the COMMAND line to display the Add SSI Context Definition panel, as shown in Figure 42.

Add a New Context

```
17MAR2001  11:10:14 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =CONDEF============SYSD=====*========(00 EDIT          )====PLEXMGR==D===10

  ------------------------- ADD SSI CONTEXT DEFINITION ---------------------
  COMMAND ===>

  SSI Context ===>
  Description ===>

  Inclusion Filters: (Target is included if any are true)
    1TGTNAME = IN (DB1P,DB2P)
    2
    3
    4
    5
    6
    7
    8

  Equivalent SUBSTITUTION parameters to be used in filter expression:
   %1=TGTNAME     %2=TGTSYSTEM   %3=TGTPRODUCT  %4=TGTSERVER
   %5=TGTDESC

  Type  END to add the SSI context definition
        CANcel to leave without adding
```

Figure 42. Add SSI Context Definition Panel

In this panel, you define the context name and description and the selection filters for the targets that will be part of this context. Help is available on each of the fields.

You can define several filter conditions, but, in this case, all you will need is to filter by **TGTNAME** (the shorthand for this is **%1**). Since most sites use some kind of naming convention for the members, you probably only need one filter condition; for example:

```
%1 = DB?P
```

would include DB2s named DB1P, DB2P, and so forth.

If you prefer, you can define an IN list; for example:

```
TGTNAME IN (DB1P,DB2P)
```

would include only the DB2s named DB1P and DB2P.

9. Type the following commands to activate this definition:

   ```
   END       (to return to the CONDEF view and complete the ADD)
   SAVE      (to save the information)
   INSTALL   (to dynamically activate this SSI context in this CAS)
   ```

10. If there are multiple CASs involved, you need to complete this definition in each CAS. (CASACT will show you a list of CASs and you can type **CON casid** to switch to another CAS.)

11. If they all share the same BBPARM (you still see the new definition after you switch to another CAS), you only need to type

    ```
    CONDEF
    EDIT
    INSTALL
    ```

    Otherwise, you must repeat the whole set of steps.

Check Current Group Activity

Often you just want to check the health of each member of your data sharing group, and check on the activity levels. The previous dialogs covered how to check on multiple DB2s subsystems and their active threads. For data sharing, all you need to do is focus on just a data sharing group, instead of the default SSI context of ALL used earlier.

To view activity for a data sharing group:

1. You should have already set the context in the previous step. As a shortcut in the future, you can also simply type

   ```
   CON context     (example: CON DBGHC)
   ```

2. Now you can select options from the EZDSSI menu to look at just this group. Try the **Status Overview** option again.

Look at Page Set Considerations (I/O / GBP-DEP)

Data sharing means that some or all of the DB2 tables can be accessed concurrently from all members of the group. But the tools provided by DB2 to understand the impact of this are limited. This section shows the power of what SSI can do to make this easier.

To look at page set considerations:

1. One of the key tuning areas in DB2 is I/O analysis. But looking at I/O for shared page sets or volumes from one DB2 member at a time does not give a complete picture.

   Select **Volume I/Os (SSI)** from the data sharing section in EZDSSI to see a view of total I/O per volume from all members (PSVOLSSI), as shown in Figure 43.

Volume I/O for the Group

```
17MAR2001  15:46:52 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSVOLSSI=========(DBGHC====*=======)17MAR2001==15:46:37====MVDB2===D====13
            Sync   I/O Sync Max  Sync Avg                  Async   I/O    Async
 Volume     I/Os    %  I/O Wait  I/O Wait 0....20...40     I/Os    %     Pages
 BAB309        6   0.4       31        17 *****              2   0.0         2
 BAB310      309  19.9      354        23 *******           31   0.5       104
 BAB311        3   0.2       38        20 ******             0   0.0         0
 BAB312     1120  72.3    10322        32 **********      5732  91.8     44287
 BAB314        8   0.5       98        29 *********          0   0.0         0
 BAB317       36   2.3      176        27 ********           0   0.0         0
 BAB318        5   0.3       27        16 *****             0   0.0         0
 BAB322       12   0.8       38        14 ****             449   7.2      3535
 BAB325        9   0.6       52        16 *****              0   0.0         0
 BAB330        8   0.5      104        25 ********           0   0.0         0
 BAB331        8   0.5       30        15 ****              19   0.3       143
 BAB332       15   1.0       30        10 ***                8   0.1        61
 TSG314       11   0.7       31        16 *****              3   0.0        14
```

Figure 43. Volume I/O SSI Summary—Session (PSVOLSSI)

2. Select **one of the volumes** to see how many page sets are being accessed on that volume from each DB2 (PSVOLSZ), as shown in Figure 44.

Volume I/O per Member

```
17MAR2001  15:50:40 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSVOLSZ==========(DBGHC====*=======)17MAR2001==15:50:39====MVDB2====D====2
         DB2       Nr.     Sync   I/O Sync Max  Sync Avg                Async
 Volume Target     PSs     I/Os    %  I/O Wait  I/O Wait 0...20...40     I/Os
 BAB312 DB1HC       13       69   4.1    10322       188 **********+        0
 BAB312 DB2HC       17     1102  66.1     1796        22 ******          5732
```

Figure 44. Volume I/O Summary—Session (PSVOLSZ)

3. Select **Nr. PSs** for one of the members to see a list of each page set (PSVOLPS) with I/O data for just that member.

4. Press **PF3** to return to PSVOLSZ and select **the volume** instead.

   Now you see a list of all page sets on that volume (PSVOLPSZ) and can see how many members access each. The I/O data here shows totals for the group.

5. Select **the volume** once again.

   Now the list shows each page set with the I/O data broken down per member (PSVOLPS), as shown in Figure 45.

I/O per Page Set and Member

```
17MAR2001  15:53:44 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSVOLPS==========(DBGHC====*=======)17MAR2001==15:53:33====MVDB2===D====30
        ------Page Set-------  DB2         Sync  Sync Max  Sync Avg
 Volume Database Object   Prt Target       I/Os  I/O Wait  I/O Wait 0...20..40
 BAB312 DSNDB01  DSNLLX02 001 DB1HC           4        29        12 *
 BAB312 DSNDB01  DSNLLX02 001 DB2HC          11        28        24 **
 BAB312 DSNDB01  DSNSPT01 001 DB1HC           5        28        17 **
 BAB312 DSNDB01  DSNSPT01 001 DB2HC           8        29        15 **
 BAB312 DSNDB01  SPT01    001 DB1HC           3        36        27 ***
 BAB312 DSNDB01  SPT01    001 DB2HC          21        40        13 *
 BAB312 DSNDB06  DSNADH01 001 DB1HC           3        43        17 **
 BAB312 DSNDB06  DSNADH01 001 DB2HC          23       221        37 ****
 BAB312 DSNDB06  DSNATX01 001 DB2HC          13       145        30 ***
 BAB312 DSNDB06  DSNATX02 001 DB1HC          12       155        40 ****
 BAB312 DSNDB06  DSNATX02 001 DB2HC         139        98        17 **
```

Figure 45. Volume Page Sets (PSVOLPS)

6. Press **PF3** to return to EZDSSI; then select the **Tuning Wizards** option, and then the **Data Sharing Wizard**.

7. There are several paths you could take on this panel, but first look down at the **Page Set Considerations** section. This provides another way to get to the Volume I/O data you just looked at, but we are now going to select the option to **Check GBP-DEP per Member** to see the level of sharing, as shown in Figure 46.

Check GBP-DEP per Member

```
17MAR2001  16:01:31 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZDSDEP==========(DBGHC====*=======)17MAR2001==16:01:30====MVDB2====D====2
 DB2      MVS         GBP   Local  Remote Log Recs  Ckpts To  Mins. To   Delete
 Target   System      DEP R/W Int R/W Int  To Ckpt PCLOSE(N) PCLOSE(T)    Names
 DB1HC    SYSC          4       4       4    50000         5        10        0
 DB2HC    SYSC          4       4       3    50000         5        10        8
```

Figure 46. Data Sharing Wizard GBP-DEP/Member (WZDSDEP)

This shows a summary of how many GBP-dependent page sets there are in the group per DB2 member, and includes the key ZPARM values that affect how long a page set remains in this status.

8. Tab the cursor to the column header, **Mins to PCLOSE(T)**, and press **PF1** to get field help on this value, as shown in Figure 47.

   Many field help panels, like this one, contain tuning tips in addition to the field definition.

Tuning Tips

```
17MAR2001  16:01:31 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZDSDEP==========(DBGHC====*=======)17MAR2001==16:01:30====MVDB2====D====2
 DB2      MVS         GBP   Local  Remote Log Recs  Ckpts To  Mins. To   Delete
 Target   System      DEP R/W Int R/W Int  To Ckpt PCLOSE(N) PCLOSE(T)    Names
 DB1HC    SYSC
 DB2HC    SYSC             Help       Pseudo-Close Timer Parameter       Help
                           Command ==>                       Scroll ==> CSR
                           -------------------------------------------------

                           This value lists the amount of time, in minutes,
                           that must elapse before a data set can be a
                           candidate for pseudo-close (QWP1TMR).

                           ZPARM name: PCLOSET in DSN6SPRM

                           Tuning Tip: The PCLOSEN and PCLOSET parameters are
                                       associated with pseudo-close. PCLOSEN
                                       defaults to 5 system checkpoints and
                                       PCLOSET defaults to 10 minutes. There
                                       is a trade off in setting these
                                       parameters. If these values are set
                                       too high, data sets may remain
                                       GBP-dependent for longer than
                                       necessary and incur unnecessary
                                       performance overhead. If these values
```

Figure 47. Field Help

9. Press **PF3** to return to the Data Sharing Wizard (WZDSHAR) and select the option to **Check GBP-DEP by GBP/PS**.

Per Group Buffer Pool

```
17MAR2001  16:18:16 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSBPGBPZ=========(DBGHC====*=======)17MAR2001==16:18:15====MVDB2====D====2
 Bfrpl   DB2       Nr.    GBP        Local         Remote       VP        VP
  ID     Target    PSs Dependent  R/W Interest  R/W Interest  Current  Changed
 BP00    DB1HC      56         2             1             1      200        0
 BP00    DB2HC      72         2             1             1       88        1
```

Figure 48. Buffer Pool Page Set GBP-DEP Summary (PSBPGBPZ)

   This summarizes the same data, also for the whole group, but now organizes it per group buffer pool and member.

10. Select one pool (**Bfrpl ID**) to see a list of all the open page sets in that pool for all targets.

11. Press **PF3** to return to PSBPGBPZ and then hyperlink on the **GBP Dependent** column to list only the GBP-dependent page sets in that pool (PSGBP), as shown in Figure 49.

Open Page Sets in One Pool

```
17MAR2001  16:19:22 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                            SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =PSBPGBPZ=PSGBP===(DBGHC====*=======)17MAR2001==16:18:15====MVDB2====D====4
 ------Page Set-------  DB2         No. GBP Local    Remote      VP       VP
 Database Object   Prt Target   Ty Usrs Dep Interest Interest  Current  Changed
 DSN8D51A DSN8S51E 001 DB1HC    PS    0  Y  R/O      R/W             1        0
 DSN8D51A DSN8S51E 001 DB2HC    PS    0  Y  R/W      R/O             0        0
 DSN8D51A DSN8S51P 001 DB1HC    TS    0  Y  R/W      R/O             2        0
 DSN8D51A DSN8S51P 001 DB2HC    TS    0  Y  R/O      R/W             0        0
```

Figure 49. Page Set GBP-DEP Status (PSGBP)

You can not only see which member(s) is GBP-dependent, but also which member(s) has Read/Write Interest and how many pages from that page set are cached in each member's local buffer pool.

Analyze Global Lock Contention

One of the most important issues in data sharing is to control global lock contention, since it not only causes the usual problems of application availability you deal with in one DB2, but can significantly degrade performance in a data sharing group as well.

To analyze global lock contention:

1. Press **PF3** to return to the Data Sharing Wizard (WZDSHAR) and select **Lock Contention Wizard**.

   The Global Lock Wizard (WZLKGOPT) is displayed, as shown in Figure 50.

Analyze Contention for a Group

```
17MAR2001  16:20:50 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZLKGOPT=========(DBGHC====*=======)17MAR2001==16:20:49====MVDB2====D====1
  ** LOCK WIZARD - GROUP **              Target Values... DB1HC

  . Check Member Contention?                                Interval   Session
    (& Select any Member)                Global Locks....      243     12900

  . Review History and set TIME?         Global Suspends.       22      1025
    (If Current Interval OK)

  . Any Gross Locks? (2 hrs)             GrossLocks......        0         0
    (Reduced Concurrency)

  . List Group Lockouts?                 Timeouts........        0         1
    (Contention Victims)                 Deadlocks.......        0         3

  . Which Resources Involved?
    (Data Hot Spots)

  . Compatible Workloads?
    (Connections Involved)

  Analyze Plans In Lockouts?
  . Global Blockers/Waiters
  . Blocker Plans
  . Waiter Plans
```

Figure 50. Global Lock Wizard (WZLKGOPT)

The Global Lock Wizard helps you step through the analysis of lock contention in DB2 for a data sharing group. It allows you to look at current status or choose an earlier time interval, perhaps one that a user of your system has complained about.

A history of the most important symptoms of lock problems—timeouts and deadlocks—is available, as well as information on system considerations and statistics that can point out potential causes of problems.

2. Select **Check Member Contention?**.

   This view, shown in Figure 51, enables you to see the key indicators for all of the members together, allowing you to identify quickly whether or not there are any global contention issues to analyze. The counts shown are for the time since DB2 started.

Check Member Contention

```
17MAR2001  16:21:53 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZLKGOPT=WZLKGMEM(DBGHC====*=======)17MAR2001==16:20:49====MVDB2====D====2
 DB2      MVS      Total    Local    Global         % of Group   Global False
 Target   System   Lockouts Suspends Suspends ..... 0....50..100  Locks  Cont.
 DB1HC    SYSC            4       42     1025  53.9 *******       12900    437
 DB2HC    SYSC            6       85      877  46.1 ******        27809    348
```

Figure 51. Lock Wizard Global Members (WZLKGMEM)

3. From here, you can hyperlink on any one DB2 to analyze its contribution to (or victimization by) global lock contention, as shown in Figure 52.

Member Lock Detail

```
17MAR2001  16:23:49 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZLKGOPT=WZLKGCON(DBGHC====DB2HC===)17MAR2001==16:20:49====MVDB2====D====1
  Global / Local Contention
                              Interval          Session
  Lockouts
   Timeouts                          0                3
   Deadlocks                         0                3

  Indicators
   % Global Contention            5.6              1.5
   . If High - Tune GBP-DEP

   % False Contention            23.3             39.7
   . If High-Tune CF (MVMVS)

  Global Lock Activity
   XES Sync Requests               239            27809
   XES Async Requests                0                7
   IRLM Suspensions                 23              513
   XES Suspensions                   0               16
   False Suspensions                 7              348
   . More Info...
  Local Lock Activity
   Lock Requests                 21959           121627
   Lock Suspensions                  0                4
   Latch Suspensions                10               57
   . More Info...
```

Figure 52. Lock Wizard Global/Local Contention (WZLKGCON)

This view provides the information to analyze both global and local lock contention for a selected member. Besides the most critical statistics, both for the current interval and since DB2 startup, the two key indicators of % global contention and % false contention are calculated for you. Thresholds are defined to highlight any value that exceeds the recommended value. Place the cursor on the **% Global Contention** header or fields to see an explanation of the calculation and what it means.

4. Press **PF3** to return to the Lock Wizard - Group panel (WZLKGOPT) and select **List Group Lockouts?** to see a list of the latest timeouts and deadlocks that have occurred in all the members of the group.

   The *Global Contention* flag on the right is set to YES when the conflict occurred between threads running on different members, as shown in Figure 53.

Group Lockouts Showing Global Contention

```
17MAR2001  16:25:20 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKEVSSI==========(DBGHC====*=======)17MAR2001==16:25:20====MVDB2====D====7
 Date / Time    Lockout   Victim   Victim   Victim   Victim   Victim   Global
 -------------- Type      Member   Plan     AuthID   Connect  CorrName Cont.
 17MAR-16:12:37 DEADLOCK  DB2H     RXDB2    BOLLAA2  DB2CALL  DMRDLK1   YES
 17MAR-16:10:18 TIMEOUT   DB1H     RXDB2    BOLLAA2  DB2CALL  DMRTMO2   YES
 17MAR-16:10:15 TIMEOUT   DB2H     RXDB2    BOLLAA2  DB2CALL  DMRTMO3
 17MAR-16:06:43 TIMEOUT   DB2H     RXDB2    BOLLAA2  DB2CALL  DMRDLK3
 17MAR-16:06:42 DEADLOCK  DB2H     RXDB2    BOLLAA2  DB2CALL  DMRDLK1   YES
 17MAR-15:45:46 DEADLOCK  DB2H     RXDB2    BOLLAA2  DB2CALL  DMRDLK1   YES
 17MAR-15:45:26 TIMEOUT   DB2H     RXDB2    BOLLAA2  DB2CALL  DMRDLK3
```

Figure 53. Global Lockout Events (LKEVSSI)

5. Press **PF3** to return to the Lock Wizard - Group panel (WZLKGOPT) and select **Which Resources Involved?** to analyze resource conflicts in the group, as shown in Figure 54.

Group Resource Conflicts

```
17MAR2001  16:27:13 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKRESZ===========(DBGHC====*=======)17MAR2001==16:27:12====MVDB2====D====2
 --Resource Name--  Total           % Total                          Global
 Database Object    Conflicts       0...50..100   PAGE   ROW INDEX  Conflicts
 DSN8D51A DSN8S51E          8  72.7 ********         8     0     0          5
 DSN8D51A DSN8S51P          3  27.3 ***              0     3     0          3
```

Figure 54. Lockout Resource Summary (LKRESZ)

   The first view summarizes all conflicts by table space / index space, so that you can quickly identify the objects with the most contention. The count on the right shows how many conflicts exist between members (global).

6. Hyperlink on a **resource name** showing several conflicts to see a breakdown of these conflicts by specific resource, down to a page or row level (LKRESNRZ).

   With this view, hot spots in your tables are immediately visible, as shown in Figure 55.

See Hot Spots

```
17MAR2001  16:28:44 ----------- INFORMATION DISPLAY ---------------------------
COMMAND  ===>                                                 SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKRESZ===LKRESNRZ(DBGHC====*=======)17MAR2001==16:27:12====MVDB2====D====1
 --Resource Name-- Resource   Resource  Total           % Total     Global
 Database Object   Number     Type      Conflicts       0...50..100 Conflicts
 DSN8D51A DSN8S51E 0000001200 DATAPAGE          8  72.7 ********           5
```

Figure 55. Lockout Resource Number Summary (LKRESNRZ)

7. Hyperlink on either the **resource name** or the **resource number** to view a list of each lockout event that involved this resource (LKRESD), as shown in Figure 56.

Each Event for This Resource

```
17MAR2001  16:30:21 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                            SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKRESZ===LKRESD==(DBGHC====*=======)17MAR2001==16:27:12====MVDB2====D====8
 --Resource Name-- Resource   Resource   Time   Lockout  Blocker  Waiter   Gbl
 Database Object   Number     Type     -------- Type     PlanName PlanName Con
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:12:37 DEADLOCK RXDB2    RXDB2    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:10:18 TIMEOUT  RXDB2    RXDB2    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:10:18 TIMEOUT  RXDB2    RXDB2    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:10:15 TIMEOUT  RXDB2    RXDB2
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:06:43 TIMEOUT  RXDB2    RXDB2
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 16:06:42 DEADLOCK RXDB2    RXDB2    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 15:45:46 DEADLOCK RXDB2    RXDB2    Yes
 DSN8D51A DSN8S51E 0000001200 DATAPAGE 15:45:26 TIMEOUT  RXDB2    RXDB2
```

Figure 56. Lockout Resource Conflict Detail (LKRESD)

This view helps you quickly determine which plans are involved in the contention and whether or not the problem was occurring only at a particular time, perhaps because of an application affinity problem.

8. Press **PF3** to return to the Lock Wizard - Group panel (WZLKGOPT) and select **Global Blockers/Waiters?** to see which plans are involved in the lockouts, as shown in Figure 57.

Which Plans Involved?

```
17MAR2001  16:31:40 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                            SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =LKBWZSSI=========(DBGHC====*=======)17MAR2001==16:31:37====MVDB2====D====3
 Blocker  Blocker  Waiter   Waiter   Timeout Deadlock        % Conflicts   Gbl
 PlanName Member   PlanName Member   Involv.  Invovl.   .... 0....50..100  Con
 RXDB2    DB1H     RXDB2    DB2H           1        3   36.4 ****           4
 RXDB2    DB2H     RXDB2    DB1H           1        3   36.4 ****           4
 RXDB2    DB2H     RXDB2    DB2H           3        0   27.3 ***            0
```

Figure 57. Lockout Global Blocker Waiter Summary (LKBWZSSI)

This view lists a summary of blocker/waiter plans and systems. You can identify conflicting plans across multiple data sharing DB2 members. Again, the list of events for a particular combination is available with a hyperlink, so you can quickly check to see if there are any application scheduling problems.

Tune Group Buffer Pools

After global locking, the next most important area of data sharing tuning is to determine whether or not the group buffer pools are the right size and have the correct ratio of directory to data entries to support your workload, based on the amount of inter-DB2 sharing that is occurring.

If any of these resources is lacking, overhead increases in the group buffer pools, the coupling facility, and the local pools. It can also cause unnecessary I/O.

To tune the group buffer pools:

1. Press **PF3** to return to the Data Sharing Wizard (WZDSHAR) and select **Review Group (Session)** to see an overview of key statistics about

   - Global Contention
   - Group buffer pool performance
   - GBP-dependent page sets
   - Coupling facility activity (castouts, failures)

Data Sharing Member Overview

```
17MAR2001  16:33:40 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =WZDSGMEM=========(DBGHC====*=======)17MAR2001==16:33:40====MVDB2====D====2
 DB2      MVS      Global   Total           Read Hit %    GBP
 Target   System   Cont. %  Lockouts  ..... 0...50..100   DEP Castouts Failures
 DB1HC    SYSC         3.76        4   14.0 **              1        4        0
 DB2HC    SYSC         1.57        6   22.2 **              1       23        0
```

Figure 58. Data Sharing Wizard Group Members (WZDSGMEM)

This view shows you some of the key indicators per member. This allows you to identify quickly whether or not there are any performance issues to analyze. The counts shown are for the time since DB2 was started.

From here, you can hyperlink on any one DB2 to see all the member statistics for both the current interval and the session data since DB2 startup. Or you can return to the first panel to follow some of the analysis paths.

2. Press **PF3** to return to the Data Sharing Wizard (WZDSHAR) and select **Check GBPs** to access the GBP analysis section of the Data Sharing Wizard.

   This decision panel provides options to analyze GBP size and the ratio of directory to data entries, as shown in Figure 59.

GBP Analysis

```
17MAR2001  16:35:20 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZDSBOPT=========(DBGHC====DB******)17MAR2001==16:35:19====MVDB2====D====1
  ** DATA SHARING WIZARD - GBPs          Group GBP Values

  Check Totals per GBP
    (Select GBP for Detail)                              Interval   Session

  . GBP Size Too Small?                  Read Hit %......      0.0       6.2
    (Low Hit% / Cache Full)              Miss-Cache Full.        0         0
                                         Curr. Chngd Pgs.        0

  . Too Few Directory Entries?           Dir.Reclaims....        0         0
    (Reclaims Cause XI/DASD Reads)       XIs/Dir.Recl....        0         0

  . Too Few Data Entries?
    (Castouts More Frequent)             Castouts........        6        95
    (Castout Too Slow)                   Write Fail-Stor.        0         0
```

Figure 59. Data Sharing Wizard GBP Options (WZDSBOPT)

There are three diagnostic paths here, but, as an example, we are going to follow the path to analyze directory entries. Even if the pools are large enough, a lack of directory entries (used to register each page) can cause problems.

The key indicators on the right are there to help you decide whether or not you need to do additional analysis by following one or more paths. On this panel, all of these values are for the whole group, summarized for all GBPs.

Possible symptoms of too few directory entries are

- The occurrence of directory reclaims so that new pages can be registered
- The even worse consequence—that cross-invalidations of pages in the members' local buffer pools are occurring because of these directory reclaims

If one of these indicators is greater than 0, the field is highlighted in red.

3. Hyperlink on **Too Few Directory Entries** to see a tabular list of all defined group buffer pools, as shown in Figure 60.

GBP Group Overview

```
17MAR2001  16:36:09 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
>W1 =WZDSGBR==========(DBGHC====*=======)17MAR2001==16:36:09====MVDB2====D====9
  GBP     Curr.  Pend.    Dir.    Data   Directory  XI from   XI Read Read Hit
 Name     Ratio  Ratio  Entries  Entries  Reclaims Dir.Recl.    Miss     Ratio
 BP0          5      5      942      187         0         0       3       6.2
 BP1                            0        0         0         0       0       0.0
 BP2                            0        0         0         0       0       0.0
 BP4                            0        0         0         0       0       0.0
 BP5                            0        0         0         0       0       0.0
 BP9                            0        0         0         0       0       0.0
 BP11                           0        0         0         0       0       0.0
 BP32K                          0        0         0         0       0       0.0
 BP32K9                         0        0         0         0       0       0.0
```

Figure 60. Data Sharing Wizard GBP Directory Entries (WZDSGBR)

Now you can see each group buffer pool with the current definitions, the two key indicators we saw before for all pools (Directory Reclaims and XI from Dir.Recl. columns), and some additional related statistics.

4. From here you can select a single GBP for further analysis, as shown in Figure 61.

GBP Directory Entries (Group)

```
17MAR2001  16:37:11 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZDSGBRD=========(DBGHC====DB******)17MAR2001==16:37:11====MVDB2====D====1
  GBP Directory Entry Analysis - Detail  BP0

                                        Interval           Session
  Reclaims for Directory Entries?              0                 0
    (GBP Page/Dir Reused)

  Directory Reclaims Causing XI?               0                 0
    (Local VP Pages Invalidated)

  Also Increasing DASD Reads?
    . Check Members for:
      * XI Miss ==> DASD Reads

  GBP Hit Ratio Low?
    . Check Members for:
      * Low GBP Hit Ratio

  Definitions
    Total Size (4K Blocks)                  256
    Directory Entries                       942
    Data Entries                            187
    Current Ratio                           5
    Pending Ratio                           5
```

Figure 61. Data Sharing Wizard GBP Directory Detail (WZDSGBRD)

This analysis panel provides details to help you determine whether or not a group buffer pool may have too few directory entries to support its part of the data sharing workload. It addresses the main issue—whether directory reclaims are causing cross-invalidations (XI) and probably increasing I/O.

In this panel, you now see the two key indicators again, but both as interval (current activity) and session (total since DB2 startup) counts.

The answer to the additional question of whether or not this is increasing DASD reads can only be seen by looking at statistics per member instead of at the group level.

5. Hyperlink on **Check Members for XI Miss** to see data sharing session activity counts per member for this group buffer pool, as shown in Figure 62.

Counts per GBP and Member

```
17MAR2001  16:39:04 ----------- INFORMATION DISPLAY --------------------------
COMMAND  ===>                                                SCROLL ===> CSR
CURR WIN ===> 1        ALT WIN ===>
 W1 =WZDSGBSA=========(DBGHC====*=======)17MAR2001==16:39:02====MVDB2====D====2
  GBP    DB2       Read  XI Read  NF Read  Changed   Clean Sync Read Async Read
 Name    Target   Hit %    Miss     Miss    Writes  Writes     Total      Total
 BP0     DB1HC     14.0        3       40       12       0        50          0
 BP0     DB2HC     22.2        1       13       20       0        18          0
```

Figure 62. Data Sharing Wizard GBP Size Activity (WZDSGBSA)

The XI Read Miss column now shows whether or not any members had to do additional I/O to read in pages lost through reclaims and cross-invalidation. Non-zero counts are highlighted. From here, you can also hyperlink on a GBP to see interval and session counts for that GBP.

You have seen a few of the most important areas for data sharing monitoring. You have used a Single System Image context to enable you to monitor all members of a group, both individually and summarized, and to pull all the relevant data together. Now you have the tools to master the new and complex data sharing performance issues.

Chapter 4. Tuning an Application with Trace

These scenarios teach you how to navigate easily through the MAINVIEW for DB2 trace setup panels and the displays of trace data, and acquaint you with the trace print utility.

In this practice session, you

1. Start an application trace and review the available options.
2. Review tips on running your tests with trace.
3. Look for application problems using the various trace displays.
4. Print a trace report for offline review.

Note: To complete the first exercise, DB2TRACE=D or ALL must be specified in your BBPARM USERID member. DB2TRACE=ALL must be specified to perform the I/O trace in a later exercise.

You must have authorization to update your BBPARM data set and issue the RESET USERID command (.E A userid) to make these changes. Contact your system administrator if you do not have authorization.

This practice session takes approximately two hours to complete.

Start an Application Trace

To start an application trace, begin by checking the current traces:

1. From the Primary Option Menu, select the **TRACES** option.

   ```
   OPTION ===> 4
   ```

   This panel lists all the current traces, as shown in Figure 63. They may be active and collecting data from DB2 (STATus is ACTV), or already complete but not yet purged (STATus is COMP). We will return here later to view your own trace.

Current Traces

ST Command

```
BMC Software ------------------- CURRENT TRACES -------------  PERFORMANCE MGMT
COMMAND ===>                                                  TGT ===> DB2G
                                      INPUT    INTVL ==> 3      TIME --  14:31:36
COMMANDS: ST (START APPLICATION TRACE), HT (HISTORY TRACES), TYPE
LC CMDS:  S (SELECT), W (SHOW),      M (MODIFY), I (SWITCH), Z (STOP)
          P (PURGE),  R (REPLICATE), H (HELP),   Q (QUIESCE LOGGING)
LC  PARM     TITLE                      USER ID  TARGET  TYPE AREA  STAT  LOG
    SUMMARY  DAILY ACCOUNTING TRACE     CIR11    DB2D    SUM  WKLD  ACTV  ACT
    DETAIL   TRACE OF APDT001T          PWW1     DB2D    DET  WKLD  ACTV
    BIGELAP  ELAPSED OVER 10 SEC        PWW1     DB2D    SUM  WKLD  ACTV
```

Figure 63. Current Traces Application

2. Transfer to START APPLICATION TRACE.

   ```
   COMMAND ===> ST
   ```

   You must be authorized to start a trace and to specify certain options. See your system administrator for the trace privileges you have. If you cannot start a trace, just browse these instructions and then go to “Look for Application Problems” on page 69 to view an already active trace.

Specify Options

On the Start DB2 Trace Request panel, shown in Figure 64, you can specify various options for your trace. Many traces can be started using just this first panel. If you want to review additional options, they are available on three more panels that are accessed much like DB2I SPUFI options.

Start Trace

Using Defaults

```
BMC Software ---------------  START DB2 TRACE REQUEST -------- PERFORMANCE MGMT
COMMAND ===>                                                  TGT==> DB2G

PARM     ==>         (Trace identifier)     START ==>           (hh:mm:ss)
TYPE     ==> S       (S-Summary,D-Detail)   STOP  ==>           (hh:mm:ss/#min)
STORAGE  ==> 1000K   (Display buffer size)  WRAP  ==> YES     (Y/N wrap buffer)
LOGTRAC  ==> N       (Y/N log trace)        RST   ==> HOT     (HOT,PUR,QIS)
TITLE    ==> DB2 APPLICATION TRACE

Specify Selection Criteria:
DB2PLAN  ==>
DB2AUTH  ==>
DB2CONN  ==>
DB2CORR  ==>
DB2LOC   ==>
DB2PKG   ==>
CONNTYPE ==>

Specify additional trace options:    (*   = processed)
Exception Filters          ==> N  (Y/N)
Detail Trace Options       ==> N  (Y/N)
Trace Log Data Set Options ==> N  (Y/N)

                                        Press ENTER to process; END to cancel
```

Figure 64. Start DB2 Trace Request Panel

1. Define a trace using mostly defaults.

   a. `PARM ==>` **`id`**

      You can specify any name as an ID, but try to make it descriptive. For example, use your initials or an acronym for the application being tested, plus a number to identify the test: JNL003, ABCTEST1, ABC2IO.

   b. `START ==>`

      Leave blank to start the trace immediately.

   c. `TYPE ==>` **`D`**

      A Detail trace collects the DB2 accounting record and additional events (DB2 performance trace IFCIDs) per thread. The default includes the basic start and end events, plan allocation data, exceptions (like timeouts), sorts, and all the SQL statements. This can be modified on a later panel.

   d. `STOP ==>` **`10`**

      This traces for 10 minutes and then stops collecting data. Even if you decide not to log a trace, the data is available for display until the trace is purged.

   e. `STORAGE ==>` **`1000K`**

      Use the site default size for the storage buffer (used for online display).

   f. `WRAP ==>` **`Y`**

      Use the default to wrap the data in the STORAGE buffer if it fills up.

   g. `LOGTRAC ==>` **`Y`**

      Specify Y to request trace logging. This allocates a VSAM log for this trace. You can recall the data for online display or print reports until you decide to delete the data set.

   h. `RST ==>` **`HOT`**

      Use the default to restart the trace automatically without loss of data if DB2 goes down and up while you are tracing.

   i. `TITLE ==>` **`user-specified title`**

      This field is filled in with the default, but you should specify a title that will help you later to identify the contents of this trace.

   j. `DB2AUTH ==>` **`userid,SYSOPR`**

      Specify your user ID to trace your own tests. Add SYSOPR to trace prefetch reads. You can also specify other selection criteria. For a detail trace, you must specify DB2PLAN or DB2AUTH to limit DB2 tracing. This is subject to DB2 restrictions (1 plan / 8 authids, or vice versa).

      Note: If you qualify by plan, prefetch read I/O events cannot be captured.

2. Request the additional trace options to review the other panels.

```
Exception Filters          ==>  Y
Detail Trace Options       ==>  Y
Trace Log Data Set Options ==>  Y
```

3. Press **Enter** to view the next panel.

4. Review the Exception Filters panel, shown in Figure 65, but leave it empty.

Narrowing the Trace

```
BMC Software --------------- DB2 TRACE EXCEPTION FILTERS ----- PERFORMANCE MGMT
COMMAND ===>                                                   TGT -- DB2G

Specify Exception Filters:
ELAP    =>          GETPAGE  =>          MAXLOCK  =>        SQLDDL   =>
CPU     =>          PGUPD    =>          LOCKTBL  =>        SQLDYN   =>
ABORT   =>          READIO   =>          INCRBIND =>        SQLCTL   =>
UIDCOM  =>          LOCKSUSP =>          SQLSEL   =>        SQLFETCH =>
GETRIO  =>          LOCKESCL =>          SQLUID   =>        SQLTOT   =>
RLF     =>          TIMEOUT  =>          RIDFAIL  =>        CLAIMDR  =>
PWAITIO =>          PWAITLK  =>          PWAITPF  =>        PWAITOT  =>
PFREQS  =>          PFREADS  =>          HPFAILS  =>        PRLLGRP  =>
PRLLRED =>          PRLLFALB =>
```

Figure 65. DB2 Trace Exception Filters Panel

Specifying filters causes thread accounting records that do not meet the qualification to be discarded. The value can be a maximum (n) or a minimum (<n). For example, specifying ELAP ==> 10 only keeps threads with an elapsed time greater than 10 seconds. This is very useful when you are looking for poorly performing applications in an existing DB2 workload.

Note: If you specify several filters, they are ORed. A trace record is retained if any one of the comparisons is valid.

5. Press **Enter** to view the next panel.

6. Review the Detail Trace Options panel, shown in Figure 66.

Adding Detail Events

```
BMC Software --------------- DETAIL TRACE OPTIONS ------------ PERFORMANCE MGMT
COMMAND ===>                                                    TGT -- DB2G

Specify additional events:
    SQL         ===> Y  (Y/N)
    SCANS       ===> N  (Y/N)
    I/O         ===> N  (Y/N)
    LOCKS       ===> N  (Y/N)
    DDF         ===> N  (Y/N)
    DDFVTAM     ===> N  (Y/N)

Specify event compression:
    GROUP SQL   ===> Y  (Y/N)

Specify data collection buffer options:
    TRSIZE      ===> 400K     (Trace buffer size)
    TRBUFF      ===> 20       (# of trace buffers)
```

Figure 66. Detail Trace Options Panel

`TRSIZE ==>` `(value shown is the default for your site)`

This is the size of a data collection buffer. Without logging, the data collected for one transaction (thread) is limited to two buffers. If you are tracing long-running applications, you may need to increase the size. With logging, multiple buffers can be written per thread and combined automatically when recalled online or printed.

`TRBUFF ==>`

You may need to increase this value to trace more concurrent threads or to provide multiple buffers for the logging of long-running applications. The recommended number is three or more times the number of concurrent threads to be traced.

`GROUP SQL ==>` **`Y`**

Y groups many consecutive identical SQL statements together to save space and make the event trace easier to read; for example, combine many FETCHes.

7. Specify the additional DB2 events you want to trace.

```
SQL      ==>  Y      Default is Y for standard application tuning
SCANS    ==>  Y      Default is N, specify Y this time
I/O      ==>  Y      Default is N, specify Y this time
LOCKS    ==>  N      Default is N, leave as is - very expensive
DDF      ==>  N      Default is N, needed only for distributed work
DDFVTAM  ==>  N      Default is N, needed only for DDF VTAM analysis
```

Each of the other groups of events adds additional overhead. You can specify any combination; for example, SQL and I/O but no SCANS.

8. Press **Enter** to view the next panel.

9. Review the Trace Log Data Set Options panel, shown in Figure 67, but leave the defaults.

Logging the Trace

```
BMC Software -------------- TRACE LOG DATA SET OPTIONS ------ PERFORMANCE MGMT
COMMAND ===>                                                  TGT -- DB2G

Number of Logs   ===> 1          (# data sets; >1 for auto switch when full)
First Log DSN    ===>
                  Low level qualifier of DSN must be V01
                  Blank for default: CIR7.DB1D.BLANK.mmmdd.Thhmm.V01
                  Names without quotes will be prefixed with CIR7

Overwrite logs   ===> Y    (Y/N) (Action when all logs used)
Archive PROC     ===>            (Blank for none/PROCLIB member name)
Log switch time  ===>            (HH:MM that a log switch is requested)

Disposition      ===> NEW  (OLD/NEW)  If NEW, specify options below:

 Volumes         ===> (V00001,V00002,V00003)
 Primary CYLS    ===> 5               SMS Storage Class    ===> SMSSTOR
 Data DSN Suffix ===> D1              SMS Data Class       ===> SMSDATA
                                      SMS Management Class ===> SMSMGMT
```

Figure 67. Trace Log Data Set Options Panel

a. `Number of Logs ==>` **`1`**

   Multiple logs are usually needed only for continuous system traces for workload history.

b. `First Log DSN ==>`

   Leave this blank to take the generated default. You must be authorized for dynamic allocation of a trace log. See your system administrator. If you are not authorized, there is a batch job (JXT011) to preallocate a log data set. Then type the name here and change DISPOSITION to OLD.

c. `Overwrite Logs ==>` **`Y`**

   Y allows the latest trace data to be kept if it doesn't all fit in the log. N keeps the earliest trace data by quiescing the trace when full.

d. `Archive PROC ==>`

   Leave blank. Not needed for simple single-log traces.

e. `Log Switch Time ==>`

   Leave blank. Not needed for simple single-log traces.

f. `Disposition ==>` **`NEW`**

   Leave NEW unless you had to preallocate a log.

g. `Volumes ==>`

   This should be filled in with the default volume(s) for your site. If not, specify a volume the MAINVIEW for DB2 product address space (BBI-SS PAS) is allowed to use.

h. `Primary Cyls ==>`

   Use the default.

10. Specify SMS values if necessary in your shop and defaults are not set.

```
SMS Storage Class     ==>
SMS Data Class        ==>
SMS Management Class  ==>
```

11. Press **END** to process the options and return to the first panel.

Activate the Trace

All options are now specified for your trace. The trace options are set to *****. If you want to drop the related options you specified, change the ***** to **N**. To view them again, change the ***** to **Y**.

When all options are ***** or **N**:

1. Press **Enter** to submit the trace request.
2. Press **PF3** to return to the CURRENT TRACES panel.
3. Press **Enter** until the status of your trace changes to ACTV.

Data can now be collected. Enter some activity to be traced.

- If the status changes to INV (invalid), there was an error in your request that was not found in the preliminary syntax checking. An example of this kind of error would be a trace log data set allocation error because no space was available on the specified volume. You can see the detailed error messages on the Journal Log (press **PF5** to view).
- If the status changes to QIS (quiesced), the target DB2 is not up.

Review Tips on Tracing Tests

There are many different scenarios for testing. Here are some hints on tracing a few of the most common tests.

- Testing your new application during development

  1. Qualify the trace by your own AUTHID. DB2 trace overhead is only incurred for the tests of your application. Depending on the number of users of the MAINVIEW for DB2 trace in your test DB2 system, you may be able to keep your trace request active through several test iterations, consolidating them on one trace log. (Only four detail traces can be active at one time.)

  2. BIND your program after the trace is started. This captures the text and EXPLAIN data of all static SQL statements in your trace output for reference when analyzing performance. EXPLAIN=YES is not required.

  3. If you don't set an automatic stop time when requesting your trace, don't forget to stop it when you have completed testing (use the Z line command in the CURRENT TRACES option). If you have logged the trace data, you should also purge the trace when complete. You can still browse and print the data from the log (HISTORY TRACES option). Otherwise, analyze the data from the online buffers and purge the trace when you are done.

- Analyzing the performance of an existing application

  1. Qualify the trace by PLAN.

  2. Set automatic start and stop times to cover a time span in which you expect sufficient activity.

  3. If the application usually runs well with only a few occurrences of poor performance, specify exception filters to save just those that you need to analyze. For example, select only those with high elapsed or CPU times, or with many GETPAGE requests or I/Os.

- Improving the performance of a bad SQL statement

  1. You may have identified a poorly performing SQL statement and now want to try out several different variations in the syntax to determine which is best. If you have RxD2/FlexTools or a similar tool, you can modify and execute the statement directly from the source while in ISPF edit. Otherwise, make the statement executable from SPUFI.

  2. Start the trace qualified by your AUTHID.

  3. Modify and execute each variation as dynamic SQL. You want to force the thread to terminate so an accounting record will be produced. This is done automatically with RxD2. With SPUFI, you must exit each time to terminate the thread.

  4. The trace automatically captures the SQL text, EXPLAIN data (with cost factor), and the accounting record and SQL performance statistics.

     You now have all variations captured together in one trace for easy comparison.

- Comparing test to production

  1. Save the detail trace log from the last test run. Run a short detail trace in production after cutover to compare performance. You can either print batch reports or browse both trace logs in split screen mode.

Look for Application Problems

Now it is time to become acquainted with the trace displays and learn how to use them for application tuning.

There are two options on the Primary Option Menu that display trace data:

- Option 4, TRACES

  ```
  OPTION ===> 4        TRACES - Current Application Traces
  ```

  This option lists all currently active or complete trace requests. You have already viewed this option when starting your trace and checking that it started correctly. From this option you can see the trace data as it is being collected. And even after the trace is complete, it stays available here until you purge the trace.

  Trace data is posted to the display buffer only when the accounting record is written. If you are tracing a longer running thread (detail), you can view the detail events as they occur with the UTRAC display. (Select the current USERS analyzer display, line select the detail display (DUSER) for your thread, and expand to UTRAC.)

  When tracing long-running threads, logging is recommended so that data isn't lost because of buffer shortages. You should also browse the logs to view the data (see next option).

  Press **PF3** to return to the Primary Option Menu.

- Option 5, HISTORY TRACES

  ```
  OPTION ===> 5      HISTORY TRACES - Historical Trace Data Sets
  ```

  Traces that are logged are also always accessible through this option that lists all known trace log data sets. You can view your trace when it is running, after it is complete, and even after you have purged the original trace request—as long as it is worthwhile to keep the data set. This makes it easy to compare different tests, even a month or two apart, without keeping stacks of paper.

  From the log you can recall the data online or print selected reports. The trace log data sets are displayed in descending order by date and time, as shown in Figure 68, so you can easily find a newly created log. If you are looking for an older log, you can sort the display by any of the columns.

Logged Traces

```
BMC Software ----------------- HISTORY TRACES  --------------  PERFORMANCE MGMT
COMMAND ===>                                                  TGT ===> DB2G
                                          TIME --  09:36:34  SCROLL ===> CSR
COMMANDS: SORT, LOCATE, NEW, STOP, START, TYPE
LC CMDS:  S (SELECT), W (SHOW), P (PRINT), D (DELETE), E (RESET)
          V (VERIFY), N (NEW), A (ARCHIVE), F (FREE)

DIRECTORY:    CIR4.LL1X.TRACEDIR
ENTRIES USED: 1,209  FREE:   201
                                                              SCROLL RIGHT >>>
LC  DATE------TIME  TRACEID  TITLE                    USERID   TGT   STAT  ACTV
    01/03/29 22:00  LEOTST01 LEOS DETAIL TRACE       CIR4     DB2G  INV
    01/03/11 21:00  DET1     WORKLOAD DETAIL 1       CIR2     DB2G  USED  READ
    01/03/01 00:00  THRDHIST THREAD HISTORY          BABUSERS DB2G  UPDAT WRIT
```

Figure 68. History Traces Application

Figure 69 summarizes many of the ways you can navigate among the trace displays accessed from either Current Traces, Option 4, or History Traces, Option 5. It is included here for your reference.

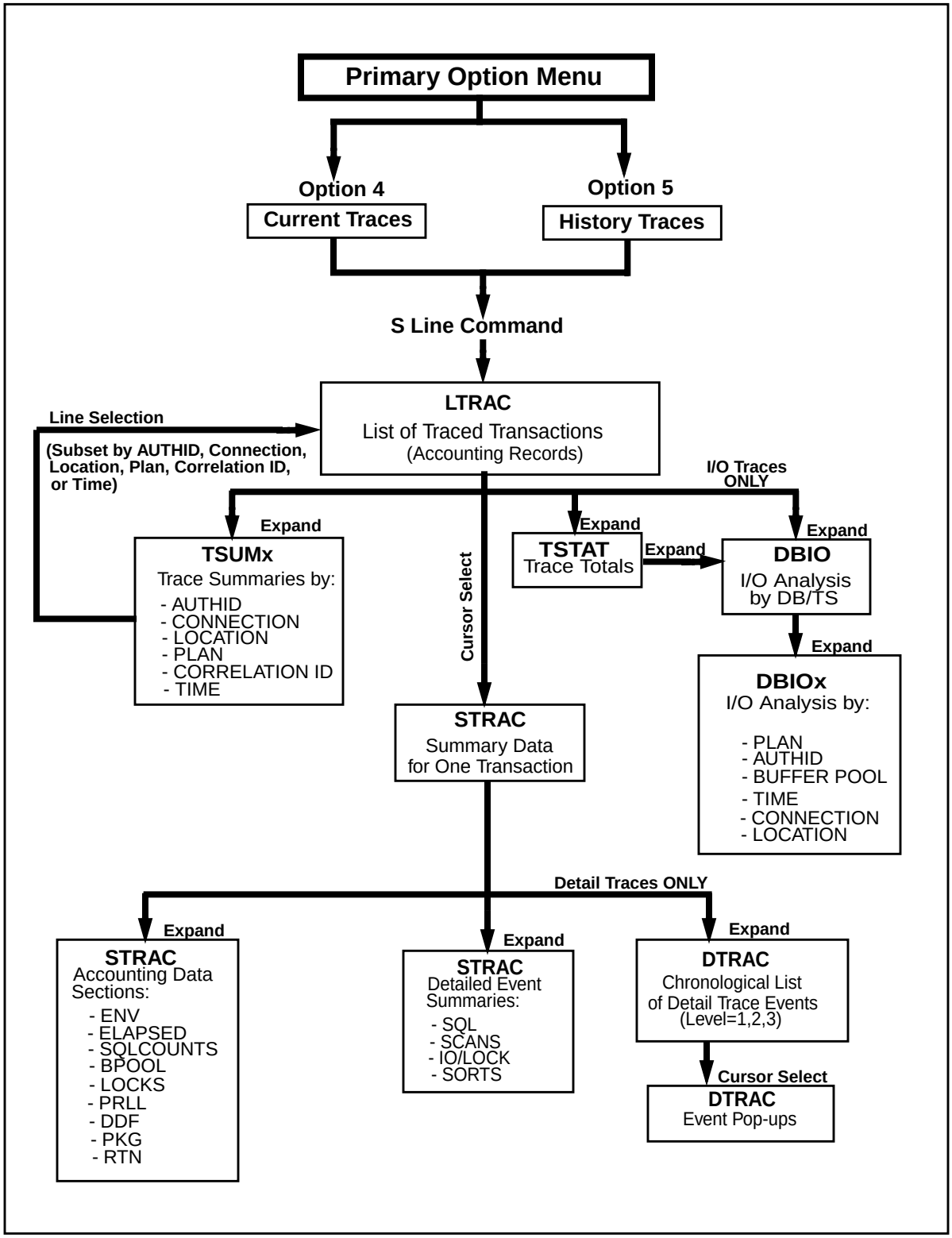

Figure 69. Trace Display Service Access

All Trace Entries (DB2 Accounting Records)

Whether selected from Option 4 or 5, all the trace displays are the same, except for a few minor differences. So we will continue here with Option 5.

To view all trace entries in a trace log data set:

1. Sort by USERID.

   ```
   COMMAND ===> SORT US
   ```

2. Locate your user ID (like ISPF LOCATE).

   ```
   COMMAND ===> L userid
   ```

3. Select the trace log data set that you just created.

   ```
   LC   (Line Command)
    S   (for Select)
   ```

   The first panel of trace data is displayed, as shown in Figure 70.

Expand from Any Entry for More Information

```
BMC Software --------------   DB2 TRACE ENTRIES     -------------  RX AVAILABLE
SERV ==> LTRAC           INPUT    14:11:09  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> PBCR02                                     ROW 1 OF 24 SCROLL=> CSR
EXPAND:  MON(WKLD), TOTALS, I/O-DB/TS, HISTORY        ENTRIES IN DATASET 1 - 132
         AUTH, CONNECT, PLAN, TIME, LOC, LINESEL(STRAC)
  19MAR01                  PBCRCP - SQL/SCAN/IO
  END TIME     PLAN    AUTHID  CONNECT   ELAPSED   CPU    # STMTS GETPAGE REASON
 ----------- -------- -------- -------- -------- -------- ------- ------- ------
 09:17:52.76 DSNTIA21 CIR8X    BATCH       13 s    268 ms       4     459 OK TRM
 09:18:10.33 DSNTIA21 CIR8X    BATCH       11 s    220 ms      12     168 OK TRM
 09:18:32.78 DSNTIA21 CIR8X    BATCH    8,768 ms   218 ms      12     162 OK TRM
 09:18:55.13 DSNTIA21 CIR8X    BATCH    9,225 ms   214 ms      12     162 OK TRM
 09:19:19.80 DSNTIA21 CIR8X    BATCH       11 s    216 ms      12     162 OK TRM
 09:19:44.59 DSNTIA21 CIR8X    BATCH       11 s    216 ms      12     162 OK TRM
 09:20:09.28 DSNTIA21 CIR8X    BATCH       11 s    217 ms      12     162 OK TRM
 09:20:34.83 DSNTIA21 CIR8X    BATCH       11 s    215 ms      12     162 OK TRM
 09:21:00.54 DSNTIA21 CIR8X    BATCH       12 s    218 ms      12     162 OK TRM
 09:21:24.18 DSNTIA21 CIR8X    BATCH       10 s    215 ms      12     162 OK TRM
 09:21:47.62 DSNTIA21 CIR8X    BATCH       10 s    217 ms      12     162 OK TRM
 09:22:05.21 DSNTIB21 CIR8X    BATCH    1,117 ms   112 ms      49      59 OK TRM
 09:22:16.03 DSNUTIL  CIR8X    UTILITY  2,907 ms   163 ms       0      64 OK TRM
 09:22:17.93 DSNUTIL  CIR8X    UTILITY  1,886 ms   107 ms       0      61 OK TRM
 09:22:36.33 DSNTIA21 CIR8X    BATCH       10 s    204 ms       4     357 OK TRM
 09:22:43.14 DSNTIB21 CIR8X    BATCH    1,981 ms    73 ms      49      32 OK TRM
 09:22:59.79 DSNTIB21 CIR8X    BATCH    1,439 ms    69 ms      49      30 OK TRM
```

Figure 70. DB2 Trace Entries Display (LTRAC)

LTRAC lists all threads (trace entries) in chronological sequence, with the newest at the bottom. Each entry corresponds to a completed transaction, query, or batch job. There is one entry for each DB2 accounting record. In addition to the thread identifiers (plan, authid, connection), some of the most important performance indicators are shown.

4. Use the scroll keys **PF7** and **PF8** to scroll back and forth in the list.

   ENTRIES IN DATASET on line 4 tells you how many threads were traced. (This line says ENTRIES IN BUFFER from a current trace.) Compare the values for ELAPSED, CPU, #STMTS, and GETPAGE and look for high activity.

5. Tab to any entry and press **Enter** to see more detailed information.

Data for One Thread

The Summary Trace Entry display, STRAC**,** shows summary data for this thread. There are complete activity statistics from the DB2 accounting record. For a detail trace, there also are summaries of the captured detail events, such as SQL statements.

The most critical information is summarized in the base section, shown in Figure 71. It includes

- Identifiers
- Completion status
- Commits and rollbacks
- A runtime graphic analysis of elapsed and CPU times
- The most important activity counts
- Key indicators of failures or possible problems

Most Critical Information

```
BMC Software -------------  SUMMARY TRACE ENTRY    ------------ RX AVAILABLE
SERV ==> STRAC           INPUT    15:14:16  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> ,SEQ=2                                    ROW 1 OF 129 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL, CURRENT                        HIST TGT--- DSN2
        ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, SPAS, DDF
        SUMMARIES:  SQL, SCANS, IO/LOCK, SORTS
STOP.....07MAY 13:35:20.20 PLAN..............DSN8CC0 TYPE.............ALLIED
START....07MAY 13:35:20.17 AUTHID.............T127 CONNECT.....LRTEST1/CICS
ELAPSED.............33 ms ORIG PRIM AUTH........T127 CORR ID.....GT00PROB
TERM......NORMAL/APPL END  COMMITS.................1 ROLLBACKS.............0
-------------------------------------------------------------------------------
RUNTIME ANALYSIS   IN DB2     IN APPL.      TOTAL    %IN DB2(=)     TOTAL(*)
----------------   --------   --------   --------   0 ...25...50...75..100%
ELAPSED TIME          14 ms      19 ms      33 ms   | ========*********** |
CPU TIME              12 ms   1,552 us      13 ms   | =======*            |
DB2 WAIT TIME          0 us
- - - - - - ACTIVITY - - - - - -      - - - - - KEY INDICATORS  - - - - - - -
TOTAL SQL.....................12     SQL: SELECT=     1, FETCH=     0
GETPAGES......................21     SQL: DYNAMIC(PREPARE)=     3
SYNC READS (PRLL=00)............0     I/O RSP: SYNC=    45 ms, ASYNC=   107 ms
PREFETCH PAGES READ.............1
UPDATES/COMMIT................0.0
BFR HIT RATIOS:...VP=100%,HP=  0%
```

Figure 71. Summary Trace Entry Display (STRAC)—Base Section

View DB2 Accounting Data

You can scroll down or expand to sections showing complete details on SQL statements by type, lock counts, buffer activity, and parallel I/O and package accounting:

1. Select **ELAPSED** in the ACCOUNTING EXPAND line.

   If you run DB2 with Accounting Trace 2 or 3 active, an Elapsed Time Analysis section is displayed, as shown in Figure 72.

Why Are You Waiting?

```
- - - - - - - - ELAPSED TIME ANALYSIS (ACCTG CLASSES 2,3 ONLY) - - - - - - - -

CATEGORY           #EVENTS AVG/EVENT  ELAPSED  %TOTAL
---------------    ------- --------- -------- ------- 0 ...25...50...75..100%
ELAPSED TIME                                          |                        |
  IN DB2                             00:12:39   99.86 | ******************     |
  IN APPLICATION                     1,038 ms    0.13 | <                      |
 --TOTALS--                          00:12:40  100.00 | ******************** |
WAITS IN DB2 (LOCAL)                                  |                        |
  LOCK/LATCH             0      0 us     0 us    0.00 |                        |
  I/O WAIT              19     21 ms   392 ms    0.05 | <                      |
  LOG WRITE I/O          0      0 us     0 us    0.00 |                        |
  OTHER READ I/O         0      0 us     0 us    0.00 |                        |
  OTHER WRITE I/O        0      0 us     0 us    0.00 |                        |
  UNIT SWITCH EVENTS                                  |                        |
  ..COMMIT/ROLLBK        0      0 us     0 us    0.00 |                        |
  ..OPEN/CLOSE           6  8,965 ms    54 s     7.07 | *                      |
  ..SYSLGRNG             1    700 ms   700 ms    0.09 | <                      |
  ..DATASPACE MGR        4    243 ms   973 ms    0.12 | <                      |
  ..OTHER                0      0 us     0 us    0.00 |                        |
  ARCH. LOG(QIS)         0      0 us     0 us    0.00 |                        |
  ARCH.READ(TAPE)        0      0 us     0 us    0.00 |                        |
  DRAIN LOCK             0      0 us     0 us    0.00 |                        |
  CLAIM RELEASE          0      0 us     0 us    0.00 |                        |
  PAGELATCH CONT.        0      0 us     0 us    0.00 |                        |
  SPAS SERVER TCB        0      0 us     0 us    0.00 |                        |
WAITS IN DB2 (GLOBAL)                                 |                        |
  LOCKS                  0      0 us     0 us    0.00 |                        |
  MSG. PROCESSING        0      0 us     0 us    0.00 |                        |
---TOTAL WAITS---       30  1,862 ms    56 s     7.34 | *                      |
*NOT ACCOUNTED                       00:11:44   92.54 | ******************     |
```

Figure 72. STRAC Elapsed Time Analysis (ELAPSED) Section

The graph tells you at a glance where the most time is being spent—and what you should concentrate on in tuning: more time in the application or in DB2; if in DB2, are the times for I/O, prefetch reads, or lock waits unusually high?

2. Select **BPOOL** in the ACCOUNTING EXPAND line.

   This section provides a complete summary of activity for each buffer pool accessed plus totals, as shown in Figure 73.

Buffer Pool Problems?

```
- - - - - - - - - - - - - - - BUFFER POOL ACTIVITY - - - - - - - - - - - - - - -
ACTIVITY                TOTAL       BP0       BP3
------------------  --------  --------  --------
GETPAGES...........        30        25         5
SYNC READS.........        25        15        10
GETPAGES/READIO....       1.2       1.7         0
COND. GP FAILURES..         0         0         0

SEQ. PREFETCH REQS.         0         0         0
LIST PREFETCH REQS.         0         0         0
DYNAMIC PREFETCHES.         2         0         2
ASYNC PAGES READ...         0         0         0
PAGES/PREFETCH REQ.       0.0       0.0       0.0

PAGE UPDATES.......         3         2         1
IMMEDIATE WRITES...         0         0         0

HP SYNC READS......         0         0         0
HP SYNC READ FAIL..         0         0         0
HP ASYNC PAGES READ         0         0         0
HP WRITES..........         0         0         0
HP WRITE FAILURES..         0         0         0

            - - - - GLOBAL BUFFER POOL (DATA SHARING ONLY) - - - -
CF READS (BUFFER CROSS INVALIDATION)
 -DATA RETURNED....         2         -         2
 -R/W INTEREST.....         1         -         1
 -NO R/W INTEREST..         1         -         1
CF READS (DATA NOT IN BUFFER POOL)
 -DATA RETURNED....         2         -         2
 -R/W INTEREST.....         1         -         1
 -NO R/W INTEREST..         1         -         1
CF-WRITE (CHGD PGS)         2         -         2
CF-WRITE (CLEAN PG)         1         -         1
```

Figure 73. STRAC Buffer Pool (BPOOL) Section

The GETPAGE / READ I/O ratio can give you a good indication of synchronous READ efficiency, which directly affects thread elapsed time. However, you should also check the prefetch requests, since some I/O may be occurring asynchronously.

3. Select each of the expand buttons shown in the ACCOUNTING line.

   This is all the data you would see with a low-overhead summary trace.

4. The package accounting section is available only if DB2 accounting class 7 is active, and shows a breakdown of elapsed, CPU, and wait times (class 8) per package/DBRM, as shown in Figure 74.

Select a Package for More Information

```
- - - - - - - - PACKAGE / DBRM OVERVIEW (ACCTG CLASSES 7,8 ONLY) - - - - - - -

PACKAGE/                                              %TOTAL
DBRM       NO. SQL  CPU TIME  WAIT TIM  ELAPSED   ELAP.
-------- --------  --------  --------  -------- ------ 0 ...25...50...75..100
RXSEL1M          5     23 ms    611 ms    860 ms   9.78 | *                    |
RXSEL2M          6     21 ms    514 ms    538 ms   6.12 | *                    |
RXSEL3M         24     38 ms    193 ms    250 ms   2.84 | <                    |
RXSEL4M          8     22 ms    765 ms    828 ms   9.43 | *                    |
RXSEL5M          9     24 ms    298 ms    337 ms   3.83 | <                    |
RXSEL6M         10     25 ms    363 ms    408 ms   4.64 | <                    |
RXSEL7M         11     26 ms    179 ms    211 ms   2.40 | <                    |
RXSEL8M         12     28 ms    270 ms    299 ms   3.40 | <                    |
RXSEL9M         13     27 ms    288 ms    351 ms   3.99 | <                    |
RXSELAM         14     28 ms    256 ms    286 ms   3.25 | <                    |
```

Figure 74. STRAC Package/DBRM Overview (PKG) Section

Select one package to see further details in a pop-up display.

5. Press **PF3** to return to STRAC.

View Detail Event Summaries (Detail Trace Only)

Since you started a detail trace, there are several more sections with data summarized from detail event records. You don't have to collect and analyze each type of data separately, the MAINVIEW for DB2 trace does it all for you. You can keep scrolling to see all the data, but there is a quicker way to select just the data you want.

SQL Statement Summary

To view summary data for each SQL statement:

1. Tab through the SUMMARIES EXPAND line to the **SQL** button and press **Enter**.

   The SQL Summary is displayed, as shown in Figure 75, with important statistics for each SQL statement, showing totals and averages across all executions. If the plan contains multiple DBRMs, the statements are sorted by package/DBRM (program).

Check Each SQL Statement

```
BMC Software --------------  SUMMARY TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> STRAC           INPUT    14:27:16  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> PBCR02,SEQ=5,SQL,SORT=PGM                   ROW 1 OF 18 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL, HISTORY
         ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, SPAS, DDF
         SUMMARIES: SQL, SCANS, IO/LOCK, SORTS

- - - - - - - - - - - - SQL SUMMARY (DETAIL TRACE ONLY) - - - - - - - - - - - -

  STMT                  AVG.     %      AVG.     %    SORT  -- PAGES SCANNED --
  TYPE   STMT  COUNT   ELAPSED  ELAP    CPU     CPU   RECS  INDX DATA WORK  REF
------- -----  -----  -------- -----  -------- -----  ----  ---- ---- ---- ----
SELECT   3228      1     25 ms   2.7  1,930 us   0.3     0     2    1    0    0
SELECT   3347      2     11 ms   2.4  4,047 us   1.5     0    11    4    0    0
OPEN     3565      6    172 us   0.1    170 us   0.2     0     0    0    0    0
FETCH    3578     11  1,986 us   2.3    782 us   1.6     0    19    3    0    0
CLOSE    3664      6    192 us   0.1    149 us   0.2     0     0    0    0    0
SELECT   3671      6  1,776 us   1.1  1,091 us   1.2     0    12    0    0    0
SELECT   3283      1  2,643 us   0.3  1,888 us   0.3     0     1    0    0    0
OPEN     3299      1    109 us   0.0    107 us   0.0     0     0    0    0    0
FETCH    3313      2    907 us   0.2    855 us   0.3     0     1    0    0    0
CLOSE    3334      1    142 us   0.0    141 us   0.0     0     0    0    0    0
OPEN     3456      1    693 ms  74.1    414 ms  74.9     8    23 1187    2    0
FETCH    3468      5    440 us   0.2    322 us   0.3     0     0    0    6    0
SELECT   4803      1  1,269 us   0.1  1,121 us   0.2     0     2    0    0    0
PGM: P025D100     44            83.9            81.0     8    71 1195    8    0

SELECT   1239      1  1,040 us   0.1  1,040 us   0.2     0     2    1    0    0
OPEN     1263      1     66 ms   7.1     47 ms   8.6   172    13    6    9    0
FETCH    1273     87    201 us   1.9    177 us   2.8     0     0    0    2    0
CLOSE    1324      1    250 us   0.0    250 us   0.0     0     0    0    0    0
OPEN     1333      1     15 ms   1.6     14 ms   2.6     7     6    4    5    0
FETCH    1343      5    254 us   0.1    254 us   0.2     0     0    0    2    0
SELECT   1375      3  1,746 us   0.6  1,165 us   0.6     0     0   12    0    0
CLOSE    1393      1    126 us   0.0    126 us   0.0     0     0    0    0    0
PGM: P025D200    100            11.4            15.0   179    21   23   18    0

SELECT    389      1     38 ms   4.2     18 ms   3.4     0    10    3    0    0
OPEN      482      1    135 us   0.0    134 us   0.0     0     0    0    0    0
FETCH     489     10    459 us   0.5    302 us   0.5     0     1    0    0    0
PGM: P025D300     12             4.7             3.9     0    11    3    0    0

** TOTALS ***    156                                    187   103 1221   26    0
```

Figure 75. STRAC SQL Summary Section

2. Scan the PERCENT ELAPSED column.

   The percent tells you how much this statement is contributing to the total thread elapsed time. An average may be high, but if only executed a few times, the statement may not be worthwhile tuning.

3. Scan the SORT RECS column to see which statements invoked a sort.

   Although EXPLAIN tells you a sort will be used, it can't tell you whether many rows will be selected and sorted, or just a few. This column does. (Of course, as always, you must adjust this by any differences between your test and production tables.)

4. Scan the PAGES SCANNED - INDX column.

   This tells you whether an index was accessed and how many pages were scanned. If this value doesn't meet your expectations, there is more information on index accesses a little further along.

5. Check for referential integrity processing. See the PAGES SCANNED - REF column.

6. Sort the display by PAGES SCANNED - DATA.

   ```
   PARM ==> traceid,SEQ=nn,SQL,SORT=PD
   ```

7. Now sort the display by PAGES SCANNED - DATA within Program.

   ```
   PARM ==> traceid,SEQ=nn,SQL,SORT=PDP
   ```

   The first characters of the column header are used to request a sort. Adding P as the third character keeps all the statements for each DBRM together. All options are defined in the HELP panels (PF1). (The sort is supported only when you expand to the section, not when you scroll to it.)

8. Place the cursor on one of the SQL statement lines and press Enter.

   This pop-up display, shown in Figure 76, shows the complete statistics for that statement, displayed as averages per execution. Where the single line shows total counts of pages scanned, the pop-up display shows averages not only for pages but also rows accessed.

Evaluate SQL Predicates

```
BMC Software -------------  DETAIL TRACE ENTRY ------------------ RX AVAILABLE
SERV ==> STRAC           INPUT    10:22:51  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> TEST3,SEQ=000017,SQL                ROW     1 OF    18 SCROLL=> CSR
EXPAND:  SQLTEXT(EXPLAIN)

STATEMENT:  350  SELECT                            NUMBER OF EXECUTIONS:      2
PLAN:       DSNESPRR                ELAPSED:  AVERAGE 2,794 us   TOTAL 5,588 us
PROGRAM:    DSNTIAUL                CPU:      AVERAGE 1,271 us   TOTAL 2,543 us
LOCATION: DB1D
PACKAGE:  SAJUYH2I                               --------- AVERAGES ---------
                                                    INDEX  SEQ-DATA  SEQ-WORK
                                                 --------  --------  --------

          ROWS PROCESSED ALL TYPES                      4         2         0
          ROWS PROCESSED CORRECT TYPE                   4         2         0
          ROWS QUALIFIED BY DM (STAGE 1)                3         0         0
          ROWS QUALIFIED BY RDS (STAGE 2)               0         0         0
          ROWS INSERTED                                 0         0         0
          ROWS UPDATED                                  0         0         0
          ROWS DELETED                                  0         0         0
          PAGES SCANNED                                 8         2         0
         REFERENTIAL INTEGRITY PROCESSING:
          PAGES SCANNED                                 0         0         0
          ROWS DELETED/SET NULL                         0         0         0
```

Figure 76. STRAC SQL Statement Pop-Up Display

These are the statistics that allow you to evaluate the SQL predicates. For example, ROWS QUALIFIED BY RDS are caused by Stage 2 predicates and are more expensive than rows qualified in the first stage by the Data Manager (ROWS QUALIFIED BY DM). Of course, there may be variations per execution depending on host variable values. You will see how to find the statistics per single statement execution later.

9. If RxD2 is installed and this is a static SQL statement, the **SQLTEXT(EXPLAIN)** expand button is highlighted. You can select this to view the SQL text from the catalog and access available EXPLAIN data from a PLAN_TABLE or do a dynamic EXPLAIN. This is shown later in Chapter 6, “Using RxD2 with MAINVIEW for DB2” on page 111.

10. Press **PF3** to return to STRAC.

Table Space / Index Space Scans

To view table space and index space scans:

1. Tab through the EXPAND line to the **SCANS** button and press **Enter.**

   Here you can see a summary of all scans by table space and index space, as shown in Figure 77.

Review Table Spaces and Index Access

```
BMC Software --------------  SUMMARY TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> STRAC           INPUT    14:27:46  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> PBCR02,SEQ=5,SCAN,SORT=DA                   ROW 1 OF 11 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL, HISTORY
         ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, SPAS, DDF
         SUMMARIES: SQL, SCANS, IO/LOCK, SORTS

 - - - - - - - - - - - DATABASE SUMMARY (DETAIL TRACE ONLY) - - - - - - - - - -

                         ------ INDX -----  ------ DATA -----  ------ WORK -----
DATABASE  PAGESET OBID  #SCAN #PAGE #ROWS  #SCAN #PAGE #ROWS  #SCAN #PAGE #ROWS
--------- -------- ----- ----- ----- -----  ----- ----- -----  ----- ----- -----
DD028     S021FT10     8    16    32   193     12     9   185      0     0     0
DD028     S021FT20    13    94    18   110      2     4    16      0     0     0
DD028     S021FT30    18     0     0     0      3    12    39      0     0     0
DD028     S021FT40    23     3     3   360      0     0     0      0     0     0
DD028     S021PR10    28     6    12     7      6  1181 44566      0     0     0
DD028     S021PR30    33    33    36   815     11    14   298      0     0     0
DD028     S021UI10    40     1     2     1      1     1     1      0     0     0
DSNDB07   DSN4K01      3     0     0     0      0     0     0      3     6     0
DSNDB07   DSN4K02      5     0     0     0      0     0     0      1     2     0
DSNDB07   DSN4K03      7     0     0     0      0     0     0      2     4     0
**** TOTALS *****         153   103  1486     35  1221 45105      6    12     0
```

Figure 77. STRAC Database Summary Section

This data is available only if you requested SCANS on the trace request. It allows you to review the number of rows and pages accessed per page set, and also see which indexes were used.

Lock and I/O Events

To analyze lock and I/O problems:

1. Tab through the EXPAND line to the **IO/LOCK** button and press **Enter**.

   This display, shown in Figure 78, is a summary of all lock and I/O activity by this application, shown by table space and index space. The lock data is available with any detail trace. The I/O data is available only if you requested I/O events on the trace request, which can be expensive, depending on the application characteristics.

Analyze Lock and I/O Problems

```
BMC Software --------------  SUMMARY TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> STRAC           INPUT    14:27:53  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> PBCR02,SEQ=5,IOLOCK,SORT=DP                 ROW 1 OF 11 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL, HISTORY
         ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, SPAS, DDF
         SUMMARIES: SQL, SCANS, IO/LOCK, SORTS

 - - - - - - - - - DATABASE LOCK AND I/O SUMMARY (DETAIL TRACE ONLY) - - - - - -

                   ------ LOCKS -----  --------- SYNC. I/O ---------  ASYNC I/O
 DATABASE  PAGESET  MAX. SUSP. TM/OUT   READ WRITE  ELAPSED AVG.ELAP  READ PAGES
 -------- -------- ----- ----- ------  ----- ----- -------- -------- ----- -----
 B1C0DB   BB040A12     0     0      0      1     0    21 ms    21 ms     0     0
 B2C0DB   BB051012     2     0      0      1     0    18 ms    18 ms     0     0
 B3C0DB   BB09TS02     3     0      0      0     0     0 us     0 us     0     0
 **** TOTALS *****     5     0      0      2     0    39 ms    19 ms     0     0
```

Figure 78. STRAC Database Lock and I/O Summary Section

For traces by AUTHID, where SYSOPR is included, you will also see counts for prefetch read requests and the number of pages read for this thread. The other counts are all for synchronous I/O within the application. In other words, the ELAPSED time shown here is part of the total thread elapsed time. Reducing the total number of synchronous I/Os has a direct effect on performance.

We will show you later how to relate these I/Os to the packages/DBRMs and even the SQL statements that caused them. (See “Application I/O Analysis” on page 86.)

Avoiding Expensive Lock Event Traces

A lock trace is usually only requested to analyze a specific locking problem, since it causes a great deal of DB2 overhead and also generates many trace records for MAINVIEW for DB2 to store online and/or log. Therefore, before you decide to trace LOCK events, you should analyze the following detail trace events available in DTRAC (shown next):

LOCK-SUMMARY (display LEVEL=2)
: This event appears near the end of the thread processing. It shows the maximum number of page locks held and the highest lock state for each page set (table/index space) accessed.

LOCK-TMO (display LEVEL=1)
: This event is shown for any thread terminated by either a timeout or deadlock. It shows the page set involved and identifies the first holder of the lock that was in contention, as well as the state of the lock (for example, held exclusive). It is followed by either a DEADLOCK or LOCK-TMO-DET event (display LEVEL=2) that gives complete details.

LOCK-SUSP (display LEVEL=3)
: This event is shown for all lock suspensions. It shows the elapsed time suspended, the page set, the type of entity locked (for example, a data page, index tree, and so on), page number if applicable, and lock state.

Sort Information

To evaluate the impact of sorting:

1. Tab through the EXPAND line to the **SORTS** button and press **Enter**.

   A Sort Summary of all the sort activity for this plan execution is displayed, as shown in Figure 79.

Evaluate Impact of Sorting

```
BMC Software --------------  SUMMARY TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> STRAC           INPUT    14:27:16  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> PBCR02,SEQ=5,SORTS                          ROW 1 OF 18 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL, HISTORY
         ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, SPAS, DDF
         SUMMARIES: SQL, SCANS, IO/LOCK, SORTS

- - - - - - - - - - -  SORT SUMMARY (DETAIL TRACE ONLY) - - - - - - - - - - -

                                        SORT      SORT      RECORD
                                     ELAPSED    RECORDS     SIZE
                                    --------   --------   -------
NUMBER OF SORTS........6    AVERAGE     135 ms         31      353M
AVG # WORK FILES.....1.3    MAXIMUM     263 ms         86    2,118M
                            MINIMUM     263 ms          3         0
                            TOTAL       263 ms        187       N/A
                       ********** END OF DATA **********
```

Figure 79. STRAC Sort Summary Section

When scrolling through STRAC, this section is at the end of the display. The SORT ELAPSED time allows you to evaluate the impact of sorting on the total thread elapsed time. Since there may be multiple sorts, the values are shown as averages, maximums, minimums, and totals.

Now you have seen all the summarized data for one thread by browsing through an STRAC (Summary Trace Entry) display. Even with a low-overhead summary trace, the complete accounting data, elapsed time analysis, buffer pool usage analysis, and DDF information is available. The other summarized data depends on the type of events you decide to trace: SQL, SCANS, IO, LOCKS.

2. Press **PF3** several times until you return to the initial STRAC display.

Another Thread

If you have traced several thread executions, you may now want to view another thread. Look at the PARM field. The SEQ=nnnnnn field shows you the sequence number of this trace entry (accounting record plus summarized details) and allows you to navigate between entries.

To view another thread:

1. Press **PF10** to scroll to the next chronological entry.
2. Press **PF11** to scroll back to the previous entry.
3. Select the **SQLCOUNTS** expand button to view the summary of all SQL statements; then press **PF10** several times.

   The display shows the SQL counts for the following threads. This is an easy way to compare particular statistics (such as SQL, elapsed times, or GETPAGEs) for several threads.

Detail Events

There is another level of trace data available for a detail trace. It shows all the traced events for a thread in chronological sequence. To see the detail event statistics:

1. Tab through the EXPAND line to the **DETAIL** button and press **Enter.**

   The DTRAC (Detail Trace Entry) display allows you to follow the sequence of events during thread processing, as shown in Figure 80.

Follow the Sequence of Events

```
BMC Software --------------  DETAIL TRACE ENTRY --------------PERFORMANCE MGMT
SERV ==> DTRAC           INPUT    10:21:48  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> TEST3,SEQ=000017,LEVEL=2             ROW     1 OF    35 SCROLL=> CSR
EXPAND:  LINESEL(DETAIL), HISTORY
START: 09:17:11 AUTH: JEK1     PLAN: DSNTIB21 CORR: DB221REQ     CONN: BATCH
================================================================================
    EVENT        AT     ELAPSED     CPU   DETAIL
------------- -------- -------- -------- ---------------------------------
CREATE-THD        0.000    45 ms 4,492 us
 PLAN-ALLOC       0.045                    ISOLATION=CS ACQ=USE   REL=COMMIT
PKG-ALLOC         0.065                   *DSNESPCS ISO=CS ACQ=USE   REL=COMIT
PREPARE   350     0.069 1,361 ms    26 ms *RC(   0) C=DT         D/X   PS(  10)
 BIND-TEXT        0.070                   *TYPE=DYNAMIC  TEXT=SELECT * FROM DS+
 EXPLAIN          0.078                   *PLAN=DSN8IC22 COST(4.6)
 EDM-REQ          1.302   123 ms 3,964 us  DB=00000258
OPEN      524     1.489   204 us   202 us *RC(   0) C=DT
FETCH     532     1.489 2,058 ms 6,247 us *RC(   0) C=DT         D/X   PS(   2)
 OPEN-TS          2.235                    DB=DSN8D21A TS=DSN8S21D
 OPEN-TS          3.352                    DB=DSN8D21A TS=XDEPT3
FETCH     532     3.549    35 ms   441 us *RC(   0) C=DT         D/X
FETCH     532     3.615   354 us   353 us *RC(   0) C=DT         D/X
FETCH     532     3.616   335 us   335 us *RC(   0) C=DT         D/X
FETCH     532     3.620   354 us   353 us *RC(   0) C=DT         D/X
FETCH     532     3.621   386 us   387 us *RC(   0) C=DT         D/X
FETCH     532     3.672   386 us   387 us *RC(   0) C=DT         D/X
FETCH     532     3.673   337 us   337 us *RC(   0) C=DT         D/X
```

Figure 80. Detail Trace Display for a Transaction (Level 2)—DB2 Requests

   The number and type of events shown depend on how much you decided to trace (more events, more overhead). The simplest detail trace captures just the major events and exceptions in the life of the thread. This trace also has SQL, SCANS, and IO.

2. Look at the first event, CREATE-THD.

   Events like this, with start and end trace records, are matched and displayed on one line with relative start time, elapsed, and CPU times. Events that occur within another event (like I/O for a scan) are indented.

3. Look at the PARM field.

   The SEQ number is the same as that shown on the Summary display (STRAC). But now there is a new parameter of **LEVEL=2**. This parameter allows you to widen or narrow your view of all the traced events. Level 2 shows you the major events (for example, the first event you see is probably PLAN-ALLOCation) and SQL.

4. Change the level to 1 to see just the SQL statements.

   ```
   PARM ==> traceid,SEQ=nnnnnn,LEVEL=1
   ```

   Browse through the SQL statements to find one you want to know more about.

5. Tab to that statement and press **PF7** to scroll it to the top (SCROLL => CSR).

6. Change the level to 3 to see SCANS and I/O.

   ```
   PARM ==> traceid,SEQ=nnnnnn,LEVEL=3
   ```

   The events always remain in chronological sequence, and the event at the top of the screen remains there. Now you can see all of the events that occurred in processing the SQL statement—index scans, data scans, table space opens, sorts, dynamic SQL text and EXPLAIN data, I/O, and so on.

7. Move the cursor to an SQL statement and press **Enter**.

   Here are the statistics for the single SQL statement, shown in Figure 81, available in a pop-up display whenever you need them, but out of the way when browsing the events.

Event Pop-Up

Access More Information

```
BMC Software --------------   DETAIL TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> DTRAC           INPUT    10:48:24  INTVL=> 5  LOG=> N  TGT==> DB2HSR
PARM ==> ALLNEW51,SEQ=4,LEVEL=2                     ROW 1 OF 17 SCROLL=> CSR
EXPAND: .SQLTEXT(EXPLAIN)
START: 13:59:23 AUTH: BOLSMR3  PLAN: DSNTIA51 CORR: DB251REQ     CONN: BATCH
================================================================================
    EVENT        AT     ELAPSED     CPU   DETAIL
-------------- -------- -------- -------- -----------------------------------
CREATE   1817     0.475    14 s     62 ms *RC(   0) TABLESPACE DEMOS51D
================================================================================
CURSOR:    DEMOS51D
LOCATION:  DB2H
ISOLATION: READ STABILITY
REOPTIMIZ: REOPTIMIZATION FOR INPUT VARS
PACKAGE:   SAJUYH2I
PROGRAM:   DSNTIAD                              INDEX  SEQ-DATA
                                               --------  --------
        ROWS PROCESSED ALL TYPES                      6         6
        ROWS PROCESSED CORRECT TYPE                  12         6
        ROWS QUALIFIED BY DM (STAGE 1)                6         0
        ROWS QUALIFIED BY RDS (STAGE 2)               0         0
        ROWS INSERTED                                 0         1
        ROWS UPDATED                                  0         0
        ROWS DELETED                                  0         1
        PAGES SCANNED                                17        14
       REFERENTIAL INTEGRITY PROCESSING:
        PAGES SCANNED                                 0         0
        ROWS DELETED/SET NULL                         0         0
```

Figure 81. DTRAC SQL Statement Pop-Up Display

Any event that has an asterisk at the beginning of the DETAIL column has a pop-up display. The detail column shows the most important data, but many trace records have much more information available. This data varies by event type. For example, for an SQL statement, you see the return code, cursor, indicators about data access (Data/Index/Work = D/X/W), and pages scanned.

You have already seen the SQL pop-up display; the same row/page statistics are available per scan. Some other important pop-up displays are

BIND-TEXT	Text of dynamic SQL (also static SQL if BIND traced)
EXPLAIN	EXPLAIN data for dynamic SQL (also from BIND)
LOCK-SUMMARY	Summary of locks held per page set
LOCK-TMO	Identification of lock holder causing a timeout/deadlock
MULTI-INDEX	Statistics on RID list processing, success, or failure

8. Press **PF3** three times to return from DTRAC to the LTRAC list of thread entries.

Summarized Data for All Threads

Now look at data that has been summarized for all the threads that have been traced:

1. In LTRAC, tab to the **TOTALS** expand button and press **Enter** to access the TSTAT display, as shown in Figure 82.

Trace Totals

```
BMC Software --------------    TRACE STATISTICS     -------------  RX AVAILABLE
SERV ==> TSTAT           INPUT    14:13:18  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> THRDHIST,PLAN=DSNTIA22,TIME=1810-1820       ROW 1 OF 37 SCROLL=> CSR
EXPAND:  MON(WKLD), HISTORY
        ACCOUNTING: ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, SPAS, DDF
        SUMMARIES:  SCANS, IO/LOCK, SORTS, I/O-DB/TS
- - - - - - - - - - SUMMARY STATISTICS - ALL TRACE ENTRIES- - - - - - - - - - -
 -----TERMINATIONS ----------    ---------ACTIVITY----------------------------
 FIRST END..22MAY 11.07.26.38               TOTAL   AVERAGE   MAXIMUM   MINIMUM
 LAST END...22MAY 12.04.39.68            --------  --------  --------  --------
 NUMBER TRANS.............191    ELAPSED  02:05:18     39 s   00:26:40    539 us
 COMMIT/ROLLBK.....188/.....3    ELP-DB2  00:05:17  1,662 ms  00:01:13      0 us
 NORMAL TERM..............189    CPU         35 s     183 ms  2,332 ms      0 us
 -- NEW USER................2    CPU-DB2     23 s     121 ms  2,079 ms      0 us
 -- DEALLOC...............137    WAITS    00:04:14  1,330 ms  00:01:13      0 us
 -- APPL END................0    SQL         3,926         20       513         0
 -- RESIGNON................0    GETPAGES   17,280         90     1,857         0
 -- DBAT INACT.............50    SYNC RDS      424          2        70         0
 -- IFI READ................0    PFCH PGS      846          4       252         0
 ABNORMAL TERM.............1    UPD/COMT      247          1        24         0
 IN DOUBT TERM.............0    BFR HIT RATIOS:.....VP= 93%,HP=  0%
 - - - - - - KEY INDICATORS - - - - - - - - - - - - - - - - - - - - - - - - - -
 TIMEOUTS =      5
 BUFFER INCOMPLETE =      1
 TOTAL DDL =      5
 GRANTS / REVOKES =      7
 SQL: SELECT=   209, FETCH= 2,248
 SQL: INS=   155, UPD=   219, DEL=    87
 SQL: DYNAMIC(PREPARE)=   247
 I/O RSP: SYNC=    19 ms, ASYNC=   106 ms
 LOCK SUSPENSIONS =     24
 RID LIST PROCESSING USED =    314
```

Figure 82. Summary Statistics for All Trace Buffer Entries (TSTAT)—Base Section

The TSTAT (Trace Statistics) display provides a summary of all traced threads. Much of the data is similar to that shown for one thread in the STRAC display, so just browse through it using the **PF8** key or select the desired accounting data sections from the EXPAND line.

TSTAT can be useful in application tuning when you trace just one plan. It gives you an overview of the performance of the plan to see if you even need to go into further detail analysis of single thread executions. If the average values meet expectations and the maximum and minimum don't vary greatly, you may be able to stop here. Also, TSTAT summarizes the key indicator values to show whether any exceptional conditions, such as RID pool failures, have occurred. After all, the art of performance analysis and tuning is to spend your time where you get the biggest payback.

2. Press **PF3** to return to LTRAC.

Application I/O Analysis

Earlier you looked at the I/O for one thread. Now look at the I/O performed for all the threads traced.

The best way to analyze the I/O workload is to use the series of DBIOx displays, available with an expand button from either LTRAC or TSTAT on an I/O trace, as follows:

1. Tab to the **I/O-DB/TS** expand button and press **Enter** to access the DBIO display, as shown in Figure 83.

Summarized I/O Events by Page Set

```
BMC Software --------------    I/O Analysis-HT      -----------PERFORMANCE MGMT
SERV ==> DBIO            INPUT    11:02:14  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> ,SORT=DB,TOTAL                         LINE    1 OF   19 SCROLL=> CSR
EXPAND:  PLAN, AUTH, BPOOL, TIME, CONNECT, LOCATION
EXPAND:  LINESEL(DBTS), CATALOG
OPTION:  TOTAL, SYNC, ASYNC

19MAR01                     CIR2.DB2G.JQSIO.MAR19.T1818.V01
DATA     TABLE               I/O   I/O   MAX    AVG
BASE     SPACE              COUNT    %  IOWAIT IOWAIT
-------- --------       -------- ----- --ms-- --ms-- 0 ...20...40...60...80
DSNDB01  DBD01                 4   5.6     89     34 | ********              |
DSNDB01  DSNSCT02              1   1.4     28     28 | *******               |
DSNDB01  DSNSPT01              1   1.4     17     17 | ****                  |
DSNDB01  SCT02                 2   2.8     38     31 | *******               |
DSNDB01  SPT01                 4   5.6    351     95 | ******************** |
```

Figure 83. I/O Analysis by Database / Table Space Display (DBIO)

The first display (DBIO) summarizes the I/O events by database and table space. You can see the number and percent of I/O per table space and index space, as well as average and maximum I/O wait times. From here, you can use the expand buttons, line selection, and sort parameters to focus on the area of most interest, whether a particular table space, an application, or a specific time period.

2. Tab to **SYNC** on the OPTION line and press **Enter**.

   Now only synchronous I/O are displayed. SYNC is now in the PARM field. TOTAL (the default) includes both synchronous and asynchronous I/O. ASYNC shows the prefetch I/O.

3. Tab to **PLAN** and press **Enter**.

   Now the I/Os are summarized by plan.

4. Tab to the **I/O %** column and press **Enter** to sort the plans with the highest amount of I/O at the top of the list.

5. Line select one of the plans and press **Enter**.

   The original display by page set is shown again, but is now qualified to show only the I/Os for the selected plan.

   Press **PF3** to return to the DBIOP display.

6. Tab to **PKG/PGM** and press **Enter**.

   The programs (DBRMs or packages) per plan causing the I/O are now identified.

7. Tab to **SQL** and press **Enter**.

   This lowest level now identifies each SQL statement causing I/O, as shown in Figure 84.

SQL Statements Causing I/O

```
BMC Software -------------- I/O Analysis-SQL Stmt   -----------PERFORMANCE MGMT
SERV ==> DBIOS           INPUT    12:01:32  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> ,SO=PL,SYNC                          LINE    1 OF    3 SCROLL=> CSR
EXPAND:  LINESEL(DBIO), CATALOG, HISTORY
OPTION:  TOTAL, SYNC, ASYNC

19MAR01                    DB2 APPLICATION TRACE
         PACKAGE/ SQL      I/O   I/O   MAX    AVG
PLAN     PROGRAM  STMT    COUNT    %  IOWAIT IOWAIT
-------- -------- ---- -------- ----- --ms-- --ms-- 0 ...20...40...60...80
RXDB2    RXSEL2M   228       30  93.8  21464   1505 | ******************** |
RXDB2    RXSEL4M   115        1   3.1     49     49 | ************         |
RXDB2    RXSEL9M   228        1   3.1     49     49 | ************         |
```

Figure 84. I/O Analysis by SQL Statement (DBIOS)

8. At any time you can return to LTRAC (press **PF3** four times from DBIOS). Select a single thread (for example, one with a high elapsed time) and look at the I/O per page set for that one execution summarized in the STRAC IO/LOCK section.

9. Select the STRAC **DETAIL** button to view the detail events. Change the display level to **3** to see I/O events.

   You can now see each I/O in the chronological sequence in which it was executed, following the SQL statement that caused it, with elapsed and CPU times.

Print a Trace Report

You have now run a trace and viewed it online. However, depending on the results, you may want to have a hardcopy for further analysis. Batch reports can also be valuable tools during an application review meeting.

Note: This section describes printing a trace, but you may also want to look at the accounting reports produced from SMF data, either from DB2 tables or directly from the extracted DB2 accounting records. See the *MAINVIEW for DB2 Performance Reporter User Guide* for more information.

To begin this exercise:

1. Press **PF3** several times until you return to the History Traces panel (Option 5).

   This panel not only provides access to view the trace data online but also offers several line commands to simplify management of the trace log data sets:

   W Show the options used for this trace
   P Generate the JCL to print a batch report
   D Delete this data set from the trace directory
   E Reset the log data set for reuse
   V Verify that the directory entry matches the data set contents
   N Add a new data set to the directory (moved from another system)
   A Archive the data set (only if an archive started task was specified)
   F Free a data set currently being read

Usually you will need only W(SHOW), D(DELETE), and P(PRINT). We are going to concentrate now on P. You can try the others when you need those functions.

All Data per Traced Thread

To print a trace report showing all data per traced thread:

1. Select your trace log data set for print.

   ```
   LC       (Line Command)
    P       (for PRINT)
   ```

   The Batch Trace Print panel is displayed, as shown in Figure 85, where you can specify options to print a batch report.

Printing a Trace

```
BMC Software ------------ BATCH TRACE PRINT ----------------  PERFORMANCE MGMT
COMMAND ===>                                                    TIME --- 15:00

Update job ==> N (Y/N - update job statement)               (END to edit JCL)
Title line 1 ==>
Title line 2 ==>

Data Selection:
 From date  ==> 16MAR2001  Time  ==> 1125
 To   date  ==> 17MAR2001  Time  ==> 1412

   PLAN     ==>
   AUTHID   ==>
   CONNECT  ==>
   CORR     ==>
   LOC      ==>
   DB2PKG   ==>

REPORT SELECTION:
   LTRAC ==> NO                          (YES/NO)
   STRAC ==> NO                          (NO,ALL,SUMMARY,section1,section2..)
   DTRAC ==> NO                          (YES/NO)
   POPUP ==> NO                          (NO/ALL/SQL/event1,event2,....)
   TSUM  ==>          (A/C/L/P/T)        SORT     ==>       (for any TSUMx)
   TSTAT ==> NO       (SUMMARY/ALL/NO)   INTERVAL ==> 1H    (for TSUMT only)
   DBIO  ==>          (X/A/C/F/L/P/T/xx) IOSORT   ==>       (for any DBIOx)
                                         IOINTVL  ==> 10M   (for DBIOT only)
```

Figure 85. Batch Trace Print Panel

2. If this is your first time using this option, you must update your job statements.

   ```
   Update Job ==> Y
   ```

3. Press **Enter** to display a job statement data entry panel.

   Fill in the required information and return using **PF3**.

4. Set the option to **N**.

5. Fill in the options for a report.

```
TITLE1 ==> any title   Optional. Centered in first report header.
TITLE2 ==> any title   Optional. Centered in second report header.
```

   Data Selection is optional. The selection fields can be used to reduce the amount printed from a long trace. The date and time fields are primed with the start and end date-time of the trace.

```
REPORT SELECTION:
 LTRAC  ==>  N
 STRAC  ==>  ALL             Print data per thread traced.
 DTRAC  ==>  N
 POPUP  ==>  N
 TSUM   ==>
 TSTAT  ==>  N
 DBIO   ==>
```

   There are many different reports that can be generated, either singly or in combination. Browse “Printing a Trace” in Volume 3 of the *MAINVIEW for DB2 User Guide* for a full explanation of the options and to see sample reports. There is also a sample JCL member DZTBPRNT you can use when you want to generate multiple reports or print reports from SMF data. The control statements for several sample reports are provided in BBSAMP member DZJPnnnn, with comments to point out some of the most useful variations.

   The reports are based on printouts of the online displays, so the options are selected using the names of these displays, like LTRAC, STRAC, DTRAC. In this tutorial we have chosen **STRAC=ALL** as the most useful report for application tuning. It shows the following for each thread traced:

   - Basic **DB2 accounting record** data
   - **Environmental Indicators** section
   - **Elapsed Time Analysis** section
   - **SQL Statement Execution Counts** section
   - **Buffer Pool Usage Analysis** section, including Global Buffer Pools
   - **Lock Activity** section, including Global Locks
   - **I/O Parallelism** section
   - **Routines** section (stored procedures and user-defined functions)
   - **DDF Summary** section (if distributed work was done)
   - **Package/DBRM Overview** section (if accounting trace 7 is active)

   These sections are included for detail traces:

   - **SQL Summary** section with summary statistics per SQL statement
   - **Database Summary** section with scans per page set
   - **Database Lock and I/O** section with locks and/or I/O data per page set
   - **Sort Summary** section (if any sorts were performed)

6. Press **Enter** to validate your specifications.

   These options are saved in your profile and used to initialize the fields the next time this panel is requested.

7. Press **PF3** to review the generated JCL in edit mode.

   The options you specified are inserted into a pattern job DZJPTRAC in BBPROF. You may want to copy this JCL into your own UBBPROF profile data set and modify it.

8. Check the rest of the options.

   There are many more print options than can be shown on the panel. The sample job contains a short description of these options. Scroll to the bottom to review them.

9. Submit the job.

   ```
   COMMAND ===> SUB
   ```

   Of course, if you prefer, you can **SAVE** the JCL for later execution, or even **CANCEL** it completely.

10. Press **PF3** to return to the Batch Trace Print panel. You can issue another request now if desired.

Other Examples

When the job is completed, review the output. You may want to try other report combinations too. Here are a few examples:

- For an SQL statement summary per thread, sorted by Average CPU usage, followed by average SQL row processing statistics per statement:

  ```
  LTRAC  ==>  Y
  STRAC  ==>  SQL,SORTSQL=AC,SQLPOPUP
  ```

- For a detail event trace per thread, with pop-up displays per SQL statement:

  ```
  LTRAC  ==>  Y
  DTRAC  ==>  Y
  POPUP  ==>  SQL
  ```

- For SQL statement text and EXPLAIN data for all dynamic SQL executed or BINDs of static SQL:

  ```
  POPUP ==> (BIND-TEXT,EXPLAIN)
  ```

- For a summary of I/O counts and wait times per database, table space, and plan (from an I/O trace):

  ```
  DBIO ==> XP
  ```

- To summarize by plan, database, and table space:

  ```
  DBIO ==> PX
  ```

There are also many formatting options you can adjust:

NEWPAGE Control page breaks

WIDTH Specify wide (133) or narrow (81) output

LINECNT Adjust the number of lines printed per page

HEADING Suppress headings

MAXPAGES Limit the amount of output to prevent an unexpectedly high print volume

Chapter 5. Analyzing the DB2 Workload with Trace

These scenarios teach you how to use the trace displays and the sorting and selection features to pinpoint problem areas and exception threads.

In this practice session, you

1. Analyze recent workload history through Option 6—GRAPH.
2. Review past history from the trace logs.
3. Analyze DB2 I/O per table space.
4. Print workload reports for offline review.

Note: This practice session takes approximately one hour to complete.

Analyze Recent Workload History

Sometimes you may need to go back in time to analyze recent history of your DB2 workload; for example:

- To identify system and application exceptions and relate the problems to the threads that caused them
- To analyze the performance of a specific application
- To develop an understanding of the workload profile and spot deviations

Graphic Display of Thread History

MAINVIEW for DB2 sets up a summary trace of the complete DB2 workload that is started automatically and runs continuously. This trace captures the DB2 accounting records and is inexpensive to run. The system administrator may have chosen to log the data, in which case a much longer time span will be available for online recall.

To view a graphic display of this recent thread history:

1. From the Primary Option Menu, select the **GRAPH** option.

   ```
   OPTION ===> 6
   ```

   This panel displays ***thread history summarized by 10-minute intervals***, sorted with the most recent intervals at the top of the screen, as shown in Figure 86. The number of threads executed (DB2 accounting records per transaction/query/batch job) is shown, followed by averages per thread of elapsed and CPU times and number of SQL statements and GETPAGEs.

Average Values

```
BMC Software -------------- TRACE SUMMARY BY TIME   -----------PERFORMANCE MGMT
SERV ==> TSUMT           INPUT    15:38:38  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> THRDHIST,INTVL=10M,SORT=ISD,GRAPH=AVG        ROW 1 OF 2 SCROLL=> CSR
EXPAND:  LINESEL(LTRAC), HISTORY       ENTRIES IN BUFFER  1 - 53
19MAR01                        THREAD HISTORY         19MAR01 - 17MAR01
INTERVAL     #THREADS    AVG ELAPSED      AVG CPU    AVG #STMTS    AVG GETPGS
START              38      00:05:12        464 ms          34.9          67.3
--------  |----.-----|  |----.-----|  |----.-----|  |----.-----|  |----.-----|
19:00:00   ********      <             *****         **            ******
18:50:00   ****          **            *             ***           *****
18:40:00   *             *             <             ******        ****
18:30:00   *******       <             <             *             **
18:20:00   ****          *             **            **********    ******
18:10:00   **********    **********    **********    **            **********
```

Figure 86. Trace Summary by Time Display with GRAPH=AVG

2. Press **PF7** to scroll down—and back in time.
3. Specify a temporary scroll value to move back to the most recent interval.

   ```
   SERV ==> M
   ```

   Press **PF8** to scroll to the top of the display.

4. To view totals instead of averages:

   ```
   PARM ==> THRDHIST,SORT=ISD,I=10M,GRAPH=TOT
   ```

   Averages give you a better view of application performance, while the totals show system throughput. Note how the numbers in the column headers change, as shown in Figure 87. These are the maximum values detected, and the graphs show percent of maximum: red / highlighted if > 90 percent.

Total Values

```
BMC Software -------------- TRACE SUMMARY BY TIME   -----------PERFORMANCE MGMT
SERV ==> TSUMT           INPUT    15:38:38  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> THRDHIST,INTVL=10M,SORT=ISD,GRAPH=TOT        ROW 1 OF 2 SCROLL=> CSR
EXPAND:  LINESEL(LTRAC), HISTORY       ENTRIES IN BUFFER  1 - 53
19MAR01                        THREAD HISTORY         19MAR01 - 17MAR01
INTERVAL     #THREADS    TOT ELAPSED      TOT CPU    TOT #STMTS    TOT GETPGS
START              38      03:17:59         17 s           616         2,560
--------  |----.-----|  |----.-----|  |----.-----|  |----.-----|  |----.-----|
19:00:00   ********      <             *             *******       *******
18:50:00   ****          **            ***           ******        *****
18:40:00   *             *             ****          ****          ****
18:30:00   *******       <             *****         **            **
18:20:00   ****          *             **            *****         *****
18:10:00   **********    **********    **********    **********    **********
```

Figure 87. Trace Summary by Time Display with GRAPH=TOT

5. Place the cursor on a line with a lot of activity and scroll it to the top with **PF7**.

   For example, this could be a time you need to analyze because a user reported a problem.

6. Now focus on smaller time intervals by changing the **INTERVAL(I)** value.

   ```
   PARM ==> THRDHIST,SORT=ISD,I=01M,GRAPH=TOT
   ```

   Any interval in minutes or hours is accepted, but values that divide evenly into 60 (M for minutes) or 24 (H for hours) are easier to read.

7. You can also change the sequence to sort by any column.

   ```
   PARM ==> THRDHIST,SORT=TG,I=01M,GRAPH=TOT
   ```

   For example, this sorts by TOTAL GETPAGES (use the first letters of the column headers) to help identify times of high buffer activity. Or change ISD to IS to sort by INTERVAL START but with the oldest data on top.

   (You could also tab to the column you want to sort on and press Enter.)

8. After the graphics display has helped you easily identify an interval to focus on, you may want to see the numbers behind the graphics.

   ```
   PARM ==> THRDHIST,SORT=TG,I=10M,GRAPH=NO
   ```

   The numeric display shows both averages and totals.

This thread history is based on a standard Summary Application Trace. However, if there are other traces you want to view here, all you have to do is change the THRDHIST value in the PARM field to the **traceid** of any other active trace request.

Workload Analysis

The most important benefit of providing the thread history feature through the Application Trace is that all of the trace displays are available for navigation so that analysis can be done for any workload group down to the individual threads, or up to one selective summary display, as follows:

1. Locate an interval on the display that has at least 20 threads, or the largest you can find. You may need to change the interval back to **I=1H**.
2. Use the tab key to place the cursor on that line and press **Enter**.

   You are now viewing a list of each individual thread that executed in the selected interval. A TIME keyword has automatically been added to the parameters. This is the LTRAC (List Trace Entries) display that you see when selecting a trace for display (Option 4 or 5), but it is reduced to a subset of threads. (See Figure 69 on page 70.)
3. Tab through the EXPAND line to the **PLAN** button and press **Enter**.

   The panel is similar to the one you saw earlier per interval, but now the threads for the one selected interval are ***summarized by PLAN***, as shown in Figure 88.

Values for Each Plan

```
BMC Software --------------- TRACE SUMMARY BY PLAN --------------  RX AVAILABLE
SERV ==> TSUMP           INPUT    14:24:47  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> THRDHIST,TIME=1810-1820,SORT=PL,GRAPH=NO     ROW 1 OF 5 SCROLL=> CSR
EXPAND:  LINESEL(LTRAC), HISTORY              ENTRIES IN DATASET 1 - 132
 19MAR01                   THREAD HISTORY      19MAR01 - 17MAR01
           ENTRY    AVG      AVG     AVG    AVG    TOTAL    TOTAL   TOTAL  TOTAL
 PLAN      COUNT  ELAPSED    CPU   #STMTS GETPGS  ELAPSED    CPU   #STMTS GETPGS
 -------- ------ -------- -------- ------ ------ -------- -------- ------ ------
 DSNESPCS      2 5,516 ms   307 ms    3.0   70.0    11 s    615 ms      6    140
 DSNESPRR      3 5,675 ms   446 ms  100.6  109.3    17 s  1,338 ms    302    328
 DSNTIA22     12 00:01:49   281 ms   10.6  169.0 00:21:54 3,379 ms    128  2,029
 DSNTIB22     11 7,330 ms   122 ms   49.0   34.0 00:01:20 1,351 ms    539    374
 DSNUTIL       2 6,740 ms   186 ms    0.0   72.0    13 s    372 ms      0    144
 DSN8CC22      8 6,380 ms    18 ms    7.5   10.0 00:02:20   398 ms    165    220
                        *** END OF SUMMARY ENTRIES ***
```

Figure 88. Trace Summary by Plan Name

You could also have selected one of the other TSUM buttons to summarize by: **AUTHID(AUTH), CONNECTION(CONNECT)**, or **LOCATION(LOC)**.

Note: The `GRAPH=NO` change you made earlier is carried forward. You can change back to the graphic display any time by overtyping the `NO` with **`YES`**.

4. Place the cursor on one of the plans and press **Enter**.

   Now you are back at LTRAC with a list of threads executed for that one plan in the interval being investigated. A PLAN keyword has been added to the parameters.

Isolating Problems

You can continue this process of selecting, sorting, and categorizing until you have identified specific exception threads:

1. Select one thread (for example, one with a high elapsed time) and press **Enter**.

   Now you have the complete DB2 Accounting record available to you in the STRAC (Summary Trace Entry) display. Here you can see SQL counts, buffer activity (and RID processing failures), lock counts, and elapsed/CPU times, as shown in Figure 89.

Complete Accounting Record at Your Finger Tips

```
BMC Software --------------  SUMMARY TRACE ENTRY    ------------- RX AVAILABLE
SERV ==> STRAC           INPUT    15:14:16  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> ,SEQ=2                                    ROW 1 OF 129 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL, CURRENT                          HIST TGT--- DSN2
        ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, SPAS, DDF
        SUMMARIES:  SQL, SCANS, IO/LOCK, SORTS
STOP.....07MAY 13:35:20.20 PLAN..............DSN8CC0 TYPE.............ALLIED
START....07MAY 13:35:20.17 AUTHID.............T127 CONNECT.....LRTEST1/CICS
ELAPSED.............33 ms ORIG PRIM AUTH........T127 CORR ID.....GT00PROB
TERM......NORMAL/APPL END  COMMITS.................1 ROLLBACKS.............0
--------------------------------------------------------------------------------
RUNTIME ANALYSIS   IN DB2     IN APPL.      TOTAL    %IN DB2(=)     TOTAL(*)
---------------   --------   --------   --------   0 ...25...50...75..100%
ELAPSED TIME          14 ms      19 ms      33 ms   | ========********** |
CPU TIME              12 ms   1,552 us      13 ms   | =======*           |
DB2 WAIT TIME          0 us
- - - - - - ACTIVITY - - - - - -      - - - - - KEY INDICATORS  - - - - - - -
TOTAL SQL.....................12     SQL: SELECT=     1, FETCH=     0
GETPAGES......................21     SQL: DYNAMIC(PREPARE)=     3
SYNC READS (PRLL=00)............0     I/O RSP: SYNC=    45 ms, ASYNC=   107 ms
PREFETCH PAGES READ.............1
UPDATES/COMMIT................0.0
BFR HIT RATIOS:...VP=100%,HP=  0%
```

Figure 89. Summary Trace Entry Display (STRAC)—Base Section

2. If you run with Accounting Class 2 or 3, don't forget to scroll down or select the **ELAPSED** button to see the graphic display of elapsed times and wait categories.
3. The other accounting detail data can be accessed by scrolling or using the expand buttons.
4. Press **PF3** to return to LTRAC, the list of completed threads.

5. Tab through the EXPAND line to the **TOTALS** button and press **Enter** to access the Trace Statistics display, as shown in Figure 90.

Qualifiers You've Selected

```
BMC Software -------------    TRACE STATISTICS     ------------  RX AVAILABLE
SERV ==> TSTAT           INPUT    14:13:18  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> THRDHIST,PLAN=DSNTIA22,TIME=1810-1820       ROW 1 OF 37 SCROLL=> CSR
EXPAND:  MON(WKLD), HISTORY
        ACCOUNTING: ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, SPAS, DDF
        SUMMARIES:  SCANS, IO/LOCK, SORTS, I/O-DB/TS
- - - - - - - - - - SUMMARY STATISTICS - ALL TRACE ENTRIES- - - - - - - - - -
 -----TERMINATIONS ----------    ---------ACTIVITY----------------------------
 FIRST END..22MAY 11.07.26.38                TOTAL   AVERAGE   MAXIMUM   MINIMUM
 LAST END...22MAY 12.04.39.68              --------  --------  --------  --------
 NUMBER TRANS.............191    ELAPSED  02:05:18     39 s   00:26:40    539 us
 COMMIT/ROLLBK.....188/.....3    ELP-DB2  00:05:17  1,662 ms  00:01:13      0 us
 NORMAL TERM..............189    CPU         35 s     183 ms  2,332 ms      0 us
 -- NEW USER...............2    CPU-DB2     23 s     121 ms  2,079 ms      0 us
 -- DEALLOC...............137    WAITS    00:04:14  1,330 ms  00:01:13      0 us
 -- APPL END...............0    SQL         3,926        20       513         0
 -- RESIGNON...............0    GETPAGES   17,280        90     1,857         0
 -- DBAT INACT.............50    SYNC RDS      424         2        70         0
 -- IFI READ...............0    PFCH PGS      846         4       252         0
 ABNORMAL TERM.............1    UPD/COMT      247         1        24         0
 IN DOUBT TERM.............0    BFR HIT RATIOS:.....VP= 93%,HP=  0%
 - - - - - - KEY INDICATORS - - - - - - - - - - - - - - - - - - - - - - - - - -
 TIMEOUTS =      5
 BUFFER INCOMPLETE =      1
 TOTAL DDL =      5
 GRANTS / REVOKES =      7
 SQL: SELECT=   209, FETCH= 2,248
 SQL: INS=   155, UPD=   219, DEL=    87
 SQL: DYNAMIC(PREPARE)=   247
 I/O RSP: SYNC=    19 ms, ASYNC=   106 ms
 LOCK SUSPENSIONS =     24
 RID LIST PROCESSING USED =    314
```

Figure 90. Summary Statistics for All Trace Buffer Entries (TSTAT)

The TSTAT (Trace Statistics) display summarizes the data from the selected threads you were just viewing. It provides an easy way to evaluate a problem area that is broader than just one single thread execution.

The values you are looking at now summarize the performance of the one plan you previously selected. Look at the **PARM** field in the third line. You will see the selections you made by selecting lines in TSUMT **(TIME=hhmm—hhmm)** and TSUMP **(PLAN=xxxxxxxx)**.

6. To see all activity starting at a specific time, change (or add) the TIME parameter with just a start time.

   `PARM ==> THRDHIST,`**`TIME=hhmm`**`,PLAN=xxxxxxxx`

7. Press **PF3** to return to LTRAC.

   The parameter change is still in effect.

8. To see all activity for a generic group of plans, change (or add) the PLAN parameter using mask characters in the plan name (plus sign for one position, asterisk for multiple positions).

   `PARM ==> THRDHIST,TIME=hhmm,`**`PLAN=xxx*`**

   The list now shows all plans starting with 'xxx'.

We have gone through examples of using TIME and PLAN, but you can also narrow your view of the workload in the same way using the other selections.

A|AUTHID=	To select by user or user group **(TSUMA)**
C|CONNECT=	To select by connection name **(TSUMC)** (TSO, BATCH, DB2CALL, cicsid, imsid)
L|LOC=	To select by DDF location **(TSUML)**
D|DAY=	To select by relative day when the trace spans days (1 = date of first accounting record in the trace buffer) (can also be specified as a range of days)

Remember also that if you need to check whether there were any unusual conditions at a particular time, you can go to the Journal log (LOG or PF5) and do a FIND for that time to view DB2 messages and MAINVIEW for DB2 exception messages.

9. Press **PF3** to return to the Primary Option Menu.

Review Past History

In the first dialog, you browsed the recent thread history available in the online buffers. However, this thread history trace is usually set up to log continuously to several trace log data sets, switching automatically when a log is full or when a specified switch time (for example, midnight) is reached. Here are the steps to identify whether logging is defined and to access the older data.

Current Log Data Set

To access the current log data set:

1. From the Primary Option Menu, select the **GRAPH** option.

   ```
   OPTION ===> 6
   ```

   As shown before, the recent thread history from the online storage buffer is displayed. (Line 4 shows ENTRIES IN BUFFER.)

2. Look at the expand buttons in line 4.

   ```
   EXPAND: LINESEL(LTRAC),HISTORY
   ```

   This HISTORY button tells you that logging is active and there is earlier thread history available to you.

3. Tab through the EXPAND line to the **HISTORY** button and press **Enter**.

   You now have the same display of thread history, but it shows all the data on the current log data set. Depending on the way logging is set up, you may be able to see the whole day's activity, or even more. Line 4 now shows **ENTRIES IN DATASET nn - nn**.

   All of the display, sort, and selection capabilities you used earlier are available here.

Earlier Log Data Set

To access an earlier log data set:

1. If the time period in which you are interested is not in the current trace logs, you can go further back by recalling data from earlier data sets.

   ```
   SERV ==> =5          (transfer to Option 5, HISTORY TRACES)
   ```

   This display lists all available trace log data sets, sorted by the date and time logging was activated to each log, as shown in Figure 91.

Logged Traces

```
BMC Software ----------------- HISTORY TRACES  --------------  PERFORMANCE MGMT
COMMAND ===>                                                  TGT ===> DB2G
                                          TIME --  09:36:34  SCROLL ===> CSR
COMMANDS: SORT, LOCATE, NEW, STOP, START, TYPE
LC CMDS:  S (SELECT), W (SHOW), P (PRINT), D (DELETE), E (RESET)
          V (VERIFY), N (NEW), A (ARCHIVE), F (FREE)

DIRECTORY:    CIR4.LL1X.TRACEDIR
ENTRIES USED: 1,209  FREE:   201
                                                              SCROLL RIGHT >>>
LC  DATE------TIME  TRACEID  TITLE                    USERID   TGT   STAT  ACTV
    01/03/29 22:00  LEOTST01 LEOS DETAIL TRACE       CIR4     DB2G  INV
    01/03/11 21:00  DET1     WORKLOAD DETAIL 1       CIR2     DB2G  USED  READ
    01/03/01 00:00  THRDHIST THREAD HISTORY          BABUSERS DB2G  UPDAT WRIT
```

Figure 91. History Traces Application

2. Locate all the data sets for the standard thread history trace.

   ```
   COMMAND ===> SORT TR     (Sort by TRACEID)
   COMMAND ===> L THRDHIST  (Locate the history trace logs)
   ```

   All data sets created by this trace that are still cataloged are listed with the most current ones at the top.

3. Select the data set containing the time period you want to investigate.

   ```
   LC       (Line Command)
    S       (for Select)
   ```

   The LTRAC display lists all thread entries, but you can use the expand buttons to summarize, sort, and select the data you need to see.

4. Choose **TSUMT** and then specify **GRAPH=AVG**.

   This is the same display you saw for recent history in Option 6—GRAPH, but now it is for any time period kept online—whether a day, week, or year ago.

Analyze DB2 I/O

It is also possible to start other, more detailed, system-wide traces to assist in workload analysis. However, authorization is required for such traces because of the potential overhead, so you may not be able to perform the setup for this dialog. In this case, just browse through the instructions so you understand the features offered. Then you can request such a trace when you need it from your system administrator.

In this example, you analyze I/O usage per page set (table spaces and index spaces). If you run DB2 with Accounting Class 2 or 3, increases in the average I/O wait times may indicate a problem that should be investigated. You can see this value in the ELAPSED TIME ANALYSIS section of TSTAT (select any time period or application of interest), or you may want to do a trend analysis from historical data kept in Performance Reporter tables.

Run a System I/O Trace

To run a system I/O trace:

1. From the Primary Option Menu, select the **I/O** option.

   ```
   OPTION ===> 7
   ```

   The I/O Analysis Options panel is displayed, as shown in Figure 92.

Trace I/O Events

```
BMC Software --------------  I/O ANALYSIS OPTIONS   ------------  RX AVAILABLE
COMMAND ==> 7                                                   TGT==> DB2G

Display Buffer Pool I/O Data:

  1  I/O BY DB/TS   - Display Realtime Data by Database / Tablespace
  2  I/O BY BPOOL   - Display Realtime Data by Buffer Pool
  3  I/O BY VOLUME  - Display Realtime Data by Volume
  4  I/O BY DATASET - Display Realtime Data by Data Set

Display I/O Data from a Trace:

  5  CURRENT TRACES - List Current I/O Traces: n Active, nn Complete
  6  HISTORY TRACES - List All History I/O Traces

Start a DMR I/O trace:

  7  START TRACE    - Review Primed Options / Activate (Start Trace Panels)

Print SMF/GTF I/O Traces

  8  DB2 TRACE      - Print Instructions
```

Figure 92. I/O Analysis Options Panel

2. Go to the Start Trace request panels.

   ```
   COMMAND ===> 7
   ```

   You need to collect the I/O events for a short time period.

   Note: If you do not need to access the following I/O analysis online, read the instructions in Option 8 about writing DB2 I/O trace data to SMF/GTF and printing reports.

3. The required keywords to start an I/O trace are primed in the Start DB2 Trace Request panel.

   Specify any additional options necessary for this exercise and start the trace. (Possible additions to primed options are in bold type.)

   ```
   PARM     ==>  IOhhmmss             Trace ID
   TYPE     ==>  D                    Detail trace
   STORAGE  ==>  1000K                Display buffer size
   LOGTRAC  ==>  Y                    Log to dynamically allocated data set
   TITLE    ==>  DB2 I/O SYSTEM TRACE Descriptive title
   START    ==>  hh:mm:ss             Cover peak period
   STOP     ==>  15                   Stop after 15 minutes
   DB2AUTH  ==>  +                    Trace all threads
   Detail Trace Options ==> *         Next panel shows I/O events selected
      SQL    ==>  N                   SQL events turned off to reduce overhead
      I/O    ==>  Y                   Specify I/O events
      TRBUFF==>  50                   Increase buffers to trace many threads
   ```

4. Let the trace run to completion.

Analyze I/O by Page Set

To analyze I/O by page set:

1. Return to the I/O Analysis application (Option 7 from the Primary Option Menu).
2. Browse the collected trace data.

   ```
   COMMAND ===> 5        (Current Traces)
   ```

   Or, if you logged the trace:

   ```
   COMMAND ===> 6        (History Traces)
   ```

3. Select the trace you requested (traceid IOhhmmss).

   ```
   LC       (Line Command)
    S       (for Select)
   ```

   The first panel of trace data, a list of all threads executed in this time period, is displayed. However, go first to the summary data for the whole trace.

4. Tab through the EXPAND line to the **I/O-DBTS** button and press **Enter**.

   This summarizes all I/O activity by page set for the total DB2 system. It shows total (synchronous and asynchronous) I/O measurements, as shown in Figure 93.

Summarized I/O Events

```
BMC Software --------------    I/O Analysis-HT      -----------PERFORMANCE MGMT
SERV ==> DBIO            INPUT    11:02:14  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> ,SORT=DB,TOTAL                          LINE    1 OF   19 SCROLL=> CSR
EXPAND:  PLAN, AUTH, BPOOL, TIME, CONNECT, LOCATION
EXPAND:  LINESEL(DBTS), CATALOG
OPTION:  TOTAL, SYNC, ASYNC

19MAR01                     CIR2.DB2G.JQSIO.MAR19.T1818.V01
DATA     TABLE               I/O   I/O   MAX    AVG
BASE     SPACE              COUNT    %  IOWAIT IOWAIT
-------- --------       -------- ----- --ms-- --ms-- 0 ...20...40...60...80
DSNDB01  DBD01                 4   5.6     89     34 | ********             |
DSNDB01  DSNSCT02              1   1.4     28     28 | *******              |
DSNDB01  DSNSPT01              1   1.4     17     17 | ****                 |
DSNDB01  SCT02                 2   2.8     38     31 | *******              |
DSNDB01  SPT01                 4   5.6    351     95 | ******************** |
```

Figure 93. I/O Analysis by Database / Table Space Display (DBIO)

You can see the number and percent of I/O per table space and index space, as well as the average and maximum I/O sort times. You can select only the synchronous or asynchronous (prefetch) I/Os by tabbing to the **OPTION** line. Only the synchronous I/Os directly affect application response time.

5. Tab to the **AVG IOWAIT** column and press **Enter** to sort the highest average delays to the top of the display.

   The parameter is changed to `SORT=AI`. A high average I/O wait may point out possible poor DASD response times.

6. Tab to the **MAX IOWAIT** column and press **Enter** to sort the highest maximum delays to the top of the display.

   The parameter is changed to `SORT=MI`. A high maximum value may point out an occasional contention problem that could be masked in the averages.

7. Tab to the **I/O COUNT** column and press **Enter** to sort the highest number of I/Os to the top of the display.

   The parameter is changed to `SORT=IC`. Index spaces with high I/O counts may be good candidates for a separate buffer pool configured for index data.

Analyze I/O by Application

I/O problems may be caused by DASD response or contention problems, or they may be caused by the application just doing too many I/Os. To analyze I/O by application:

1. Tab to the **PLAN** button and press **Enter** to access the I/O Analysis by Plan display, as shown in Figure 94.

I/O Summarized by Plan

```
BMC Software --------------   I/O Analysis-Plan     -----------PERFORMANCE MGMT
SERV ==> DBIOP           INPUT    11:29:20  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> ,SO=PL,TOTAL                          LINE    1 OF    3 SCROLL=> CSR
EXPAND:  PKG/PGM, LINESEL(DBIO), CATALOG
OPTION:  TOTAL, SYNC, ASYNC

19MAR01                    CIR2.DB2G.JQSIO.MAR19.T1818.V01
                           I/O   I/O   MAX    AVG
PLAN                      COUNT    %  IOWAIT IOWAIT
--------                 -------- ----- --ms-- --ms-- 0 ...20...40...60...80
DSNTIA31                       29  40.8     89     19 | ****                 |
DSNTIB31                        6   8.5     38     25 | ******               |
RXDB2                          36  50.7   1028     80 | ******************** |
```

Figure 94. I/O Analysis by Plan Display (DBIOP)

   This summarizes all the I/O collected by the trace by plan.

2. Tab to the **I/O %** column and press **Enter**.

   This sorts the applications with the highest amount of I/O to the top.

3. Line select one plan.

   This returns you to the DBIO display by DB/TS, but shows only the table spaces accessed by that plan.

4. Try out some of the other summarizations, selection, and sorting options to narrow the focus of the displays.

   Of course, all the other trace displays are available, including the Lock and I/O Summary per thread (STRAC) and the detail I/O events (DTRAC).

The next section covers printing I/O reports.

Print Workload Reports

Printing workload reports is usually done from the DB2 tables of performance data supported by Performance Reporter. This gives you long-term history and trending, as well as the full flexibility of SQL for defining your own reports in addition to the predefined set. See "Reporting Facilities from DB2 Tables" in the *MAINVIEW for DB2 Performance Reporter User Guide* for more information.

Also, selective or total accounting reports, in either a short or long format, can be printed from DB2 accounting records extracted from one or more SMF files. For example, you can select from a specific time period or by plan, authorization ID, and so on. The reports also can be summarized by various criteria. See "Reporting Facilities from SMF" in the *MAINVIEW for DB2 Performance Reporter User Guide* for more information.

However, this data is often not available to answer questions about the workload until the next day. The batch trace print facility is designed to fill the need for quick reports. All the trace summary report formats are available, in any combination.

There are different types of input:

- One or more trace log data sets

  For example, of the Thread History trace.

- Archived trace logs (without reloading to VSAM)

  For example, thread history from two weeks ago.

- An SMF history file containing DB2 Accounting records or I/O trace IFCIDs
- The live SMF data sets
- A GTF trace data set

The examples in this dialog are made with the THRDHIST and system I/O traces.

To print a workload report:

1. From the Primary Option Menu, select the **HISTORY TRACES** option.

   ```
   OPTION ===> 5
   ```

2. Locate an entry with a TRACEID of THRDHIST and select it for print.

   ```
   LC      (Line Command)
    P      (for PRINT)
   ```

   The Batch Trace Print panel where you can specify options to print one batch report is displayed, as shown in Figure 95.

Specify Options

```
BMC Software ------------ BATCH TRACE PRINT ----------------  PERFORMANCE MGMT
COMMAND ===>                                                    TIME --- 15:00

Update job ==> N (Y/N - update job statement)               (END to edit JCL)
Title line 1 ==>
Title line 2 ==>

Data Selection:
 From date  ==> 16MAR2001  Time  ==> 1125
 To   date  ==> 17MAR2001  Time  ==> 1412

   PLAN     ==>
   AUTHID   ==>
   CONNECT  ==>
   CORR     ==>
   LOC      ==>
   DB2PKG   ==>

REPORT SELECTION:
   LTRAC ==> NO                          (YES/NO)
   STRAC ==> NO                          (NO,ALL,SUMMARY,section1,section2..)
   DTRAC ==> NO                          (YES/NO)
   POPUP ==> NO                          (NO/ALL/SQL/event1,event2,....)
   TSUM  ==>          (A/C/L/P/T)        SORT     ==>       (for any TSUMx)
   TSTAT ==> NO       (SUMMARY/ALL/NO)   INTERVAL ==> 1H    (for TSUMT only)
   DBIO  ==>          (X/A/C/F/L/P/T/xx) IOSORT   ==>       (for any DBIOx)
                                         IOINTVL  ==> 10M   (for DBIOT only)
```

Figure 95. Batch Trace Print Panel

You can also use the sample JCL **DZTBPRNT** to tailor and submit a set of reports. This JCL is set up so that it can invoke several sample report members that explain many of the available print options.

3. If this is the first time you are using this option, you may want to update your job statements first (Update Job ==> **Y**).

4. Fill in the options for a report.

```
REPORT ==> traceid    Specify any name. Used as the output DD.
DDNAME ==>            Optional.
TITLE1 ==> any title  Optional. Centered in first report header.
TITLE2 ==> any title  Optional. Centered in second report header.
```

   Data Selection is optional, but can be used to reduce the amount printed. The date and time fields are primed from the trace log data set.

```
REPORT SELECTION:
 LTRAC  ==>  N
 STRAC  ==>  N
 DTRAC  ==>  N
 POPUP  ==>  N
 TSUM   ==>  T            SORT     ==>
 TSTAT  ==>  SUMMARY      INTERVAL ==> 30M
```

5. Press **Enter** to validate your specifications.

   These options are saved in your profile and used to initialize the fields the next time this panel is requested.

6. Press **PF3** to review the generated JCL in edit mode.

   The options you specified are inserted into a pattern job DZJPTRAC in BBPROF. You may want to copy this JCL into your own UBBPROF data set and modify it.

7. Check the other options and add if desired; for example:

```
TSUM=T,I=30M,GRAPH=TOT
```

   Add the option to graph the totals instead of printing values. There are many other options that cannot be shown on the panel. Refer to “Printing a Trace” in Volume 3 of the *MAINVIEW for DB2 User Guide*.

8. Submit the job.

```
COMMAND ===> SUB
```

   If you prefer, you can **SAVE** or **CANCEL** the JCL.

9. Press **PF3** to return to the Batch Trace Print panel.

   You can make another request now if desired.

When the job completes, review the output. This gives you a graphic summary of total DB2 activity for the selected time period in 30-minute intervals, followed by a summary of the activity.

Here is another example:

```
LTRAC ==> Y
STRAC ==> SUMMARY          (Add ,DDF if DDF is active)
```

This provides the complete DB2 Accounting information per thread. You may want to use the data selection options to limit the output.

To print an I/O report from the system I/O trace log or from an SMF/GTF data set that has DB2 I/O IFCIDs 6 - 10:

```
DBIO=X      Summarize by database/table space
DBIO=XP     Summarize by database/table space/plan
DBIO=PX     Summarize by plan/database/table space
```

All the other summarization options of AUTHID, connect, buffer pool, location, and time are also available.

Chapter 6. Using RxD2 with MAINVIEW for DB2

In this practice session, you

1. Learn how to use RxD2/FlexTools with MAINVIEW for DB2 for SQL prototyping.
2. Access DB2 Catalog and PLAN_TABLE information or invoke EXPLAIN directly from your terminal session for either local or remote DB2 systems (remote access is through DDF connections from a local DB2).

Note: This practice session takes approximately one hour to complete.

Improve Performance with SQL Prototyping

SQL prototyping can be a valuable tuning exercise at two different times in the development cycle:

- When an application is first being developed and the basic performance characteristics of the SQL statements need to be validated against the design criteria.
- When a poorly performing SQL statement has been identified in an application and improvements are being sought.

RxD2 FlexTools provides a simple method both to execute and EXPLAIN SQL statements directly from the program source. There are often several possible methods to code an SQL statement, and the trick is to find the one with the best performance characteristics. Modifying and executing these variations while running a detail trace can simplify this task and document the results for you.

Begin by ensuring that RxD2 is accessible from your terminal session:

Note: You can access RxD2 only from a terminal session running under ISPF or MAINVIEW Alternate Access. Also, to run this scenario, your terminal session must be on the same MVS system as your source libraries and the DB2 system.

1. Go to the MAINVIEW for DB2 Primary Option Menu.

   You will see an RX option in the middle of the panel if RxD2 is installed.

2. Request this option:

   ```
   OPTION ===> RX         RxD2 FlexTools
   ```

   The RxD2 Primary Option Menu is displayed, as shown in Figure 96.

RX Is Available

```
BMC Software ------------- Primary Option Menu ---------- RxD2 FlexTools 2.1
Option ===>                                               Target ===> DB2G
                                                          Userid ---- BOLMXW2

                          DB2 Resource Administration
--------------------------------------------------------------------------------
   1  Plans                              9  Storage Groups
   2  Packages                           10 RLF
   3  Tables                             11 DDF
   4  Table Spaces                       12 Synonyms
   5  Partitions                         13 SYSCOPY
   6  Indexes                            14 Authorization by User
   7  Index Partitions                   15 Authorization by Resource
   8  Databases                          16 Stored Procedures

DB2 Application Functions            General Facilities
-------------------------            ------------------
   A1 Execute SQL                       C  DB2 Commands
   A2 DDLGEN for Tables                 D  Defaults
   A3 EXPLAIN PLAN_TABLE                T  Tutorial
   A4 EXPLAIN SQL from Edit (EXPL)      N  What's New
   A5 Execute SQL from Edit (TEX)       X  Exit
```

Figure 96. RxD2 Primary Option Menu

3. Press **PF3** to return to MAINVIEW for DB2.

When RxD2 is installed, you will also see a short message `RX AVAILABLE` at the top right of many other displays.

Start a Trace

To set up the trace for your tests:

1. Start a detail trace qualified by your AUTHID.

   ```
   OPTION ===> ST          Start Trace
   ```

   The default for a detail trace includes an SQL trace, which is usually sufficient information. If you also need to analyze data access by table space, you may want to add SCANS or I/O. Include LOCKS only for specific lock analysis, since this is very expensive. Log the trace so you can print reports later if desired.

   If you have any questions about starting a trace request, go back through the first part of the practice session in Chapter 4, “Tuning an Application with Trace” on page 59.

2. Check that the trace has started correctly.

   ```
   OPTION ==> CT          Current Traces
   ```

   Press **Enter** until your trace request appears in the list and shows as active.

Test a Statement

To start testing:

1. From the Primary Option Menu, or any command line, select RxD2.

   ```
   OPTION ===> RX        RxD2 FlexTools
   ```

   or

   ```
   COMMAND ===> RX       RxD2 FlexTools
   ```

2. Enter ISPF/PDF Edit.

   ```
   OPTION ===> A5       Execute SQL from Edit (TEX)
   ```

3. Select your program source file and member in the normal way, and then locate the statement you want to test.

   (If you have the DB2 IVP installed, you can use the DSNSAMP member DSN8MCA and choose the first statement.) (Use FIND 'EXEC SQL'.)

4. Choose the statement for execution.

   ```
   COMMAND ===> TEX
   ```

   Place the cursor on the statement text and press **Enter**.

   If you execute this from a library with an unknown source type (for example DSNSAMP), you are asked to define whether the text is in COBOL, PL/I, and so on. Otherwise, the statement is parsed immediately and primed in a panel to prepare for execution, as shown in Figure 97.

Initiate Execution

```
BMC Software ------------------- Execute   SQL --------------------------------
Command ===>                                          TARGET ===> DB2G

Location           ===> DB2G
Maximum Fetches    ===> 99999
Default SQL Action ===> COMMIT   (COMMIT,ROLLBACK)
Current SQLID      ===> BOLMXW3

Enter the SQL statement below, and press ENTER to execute:
--------------------------------------------------------------------------------
SELECT CREATOR, NAME, TYPE, DBNAME, TSNAME FROM SYSIBM.SYSTABLES ORDER BY CREAT
R,NAME
```

Figure 97. Execute SQL Panel

5. Determine the maximum number of FETCHes that should be executed.

   ```
   MAXIMUM FETCHES ==> 20
   ```

   The default is 20. If you change it here, it affects only this one execution. You also can change the default in the Defaults option (RxD2/FlexTools Primary Option Menu).

6. Define whether you want to COMMIT or ROLLBACK.

   ```
   DEFAULT SQL ACTION ==> COMMIT
   ```

   The default is COMMIT. In both cases, the thread is terminated at completion so that an accounting record is cut for each execution.

7. Modify the SQL text if necessary.

   Review and modify the SQL statement text before execution as dynamic SQL. Host variables are not supported (they are replaced by question marks in the text), so you may have to edit in appropriate values for the test. You also can delete or add clauses. It is not necessary to edit out blanks. The text will be flowed together for execution.

8. Change the current SQLID if necessary to qualify a table name or edit it into the text.

9. Press **Enter** to submit the SQL statement for execution.

   Output is returned in a scrollable display, each row separated by asterisks and the row number, followed by one line per column, as shown in Figure 98.

Results of Execution

```
BMC Software ----------------- Execute SQL Output ---- Row 145 to 180 of 1,174
Command ===>                                          SCROLL ===> CSR
                                                      TARGET ---- DB2G
Location  . . . . . : DB2G
--------------------------------------------------------------------------------
ROW # 25 ******************** 5 COLUMNS
CREATOR             = BOLMXW2
NAME                = MWTTBLA
TYPE                = T
DBNAME              = MWDBTEST
TSNAME              = MUTSPCA
ROW # 26 ******************** 5 COLUMNS
CREATOR             = BOLMXW2
NAME                = MWTTBL3H
TYPE                = T
DBNAME              = MWDBTEST
TSNAME              = MUTSPC3H
ROW # 27 ******************** 5 COLUMNS
CREATOR             = BOLMXW2
NAME                = MWTTBL3I
TYPE                = T
DBNAME              = MWDBTEST
TSNAME              = MUTSPC3I
ROW # 28 ******************** 5 COLUMNS
CREATOR             = BOLMXW2
NAME                = MWTTBL3J
TYPE                = T
DBNAME              = MWDBTEST
TSNAME              = MUTSPC3J
ROW # 29 ******************** 5 COLUMNS
CREATOR             = BOLMXW2
NAME                = MWTTBL3X
TYPE                = T
DBNAME              = MWDBTEST
TSNAME              = MUTSPC3X
ROW # 30 ******************** 5 COLUMNS
CREATOR             = BOLMXW2
NAME                = MWTTBL3Z
TYPE                = T
DBNAME              = DSNDB04
TSNAME              = H3TTBL1
```

Figure 98. Execute SQL Output Panel

10. Repeat the modification and execution of the statement for as many iterations as you need.

11. Press **PF3** to return to your edit session.

If you wish, you can now choose another SQL statement to test.

EXPLAIN a Statement

You can EXPLAIN any statement while in edit. This can be very useful when you are first creating an SQL statement. You do not need to EXPLAIN every iteration you are testing now, since the MAINVIEW for DB2 trace captures the EXPLAIN data created for the dynamic SQL. Choose one to try out now so you know how it works:

1. Choose the statement for execution.

   `COMMAND ===>` **`EXPL`**

   Place the cursor on the statement text and press **Enter**.

   You may be asked to define the source type, just as for TEX. Then the statement is parsed and primed in a panel to prepare for EXPLAIN, as shown in Figure 99.

   Note: You must have a PLAN_TABLE allocated for your AUTHID or, if changed, the current SQLID.

Initiate EXPLAIN

```
BMC Software ---------------------- EXPLAIN ----------------------------------
Command ===>                                            TARGET ===> DB2G

Location         ===> DB2G
Catalog Prefix   ===> SYSIBM
Current SQLID    ===> BOLMXW
                 (Plan_Table must exist for this SQLID)

Enter the query number to use ===> 601


SQL statement to be explained:
------------------------------------------------------------------------------
SELECT DSN8410.DEPT.DEPTNO, DEPTNAME, MGRNO, PROJNO, PROJNAME FROM DSN8410.DEPT
FULL OUTER JOIN DSN8410.PROJ ON DSN8410.DEPT.DEPTNO = DSN8410.PROJ.DEPTNO
```

Figure 99. EXPLAIN PLAN_TABLE Qualifier Panel

2. Specify the query number to identify this iteration.

   Type the query number to use `===>` **`1`**

   The default is 1.

   Review / modify the SQL statement text before EXPLAINing it. Host variables are replaced with parameter markers (questions marks) in a format acceptable to EXPLAIN.

3. Press **Enter** to submit the SQL statement to be EXPLAINed.

   The EXPLAIN output is returned in a formatted, scrollable display, as shown in Figure 100.

Results of EXPLAIN

```
BMC Software ----------------- EXPLAIN PLAN_TABLE ------------ Row 1 to 2 of 2
Command ===>                                          SCROLL ===> CSR
                                                      TARGET ---- DB2G
Catalog Prefix   ===> SYSIBM
Location         ===> DB2G
PLAN_TABLE  . . . . : BOLMXW.PLAN_TABLE

Commands: SORT (Q,PL,PK,CO,DT)
LC CMDS:  P  (plan detail)            T  (table detail)
          PK (package detail)         X  (index detail)
          M  (more detail)
LC QNO   STP BLK MXSEQ PLAN     PGM      COLLECTION          DATE     TIME
-- ----- --- --- ----- -------- -------- ------------------ -------- --------
     601   1   1     0          RXSEL1M  RXD2               20010317 14491881
   Method: First Table Accessed
   Access: Sequential Scan                    Prefetch: Sequential
   Tslock: IS                          Access Seq(Tabno): 1
   Table:  DSN8410.DEPT                Correlation:
   Index:                              Matching    0 Keys
   Sort-New Table: None                     Composite: None
-------------------------------------------------------------------------------
     601   2   1     0          RXSEL1M  RXD2               20010317 14491881
   Method: Merge Scan Join          Full Outer Join
   Access: Sequential Scan                    Prefetch: Sequential
   Tslock: IS                          Access Seq(Tabno): 2
   Table:  DSN8410.PROJ                Correlation:
   Index:                              Matching    0 Keys
   Sort-New Table: JOIN                     Composite: JOIN
-------------------------------------------------------------------------------
****************************** Bottom of data ******************************
```

Figure 100. EXPLAIN PLAN_TABLE Output Panel

4. Most of the important information is available on this first display, but you can use line command **M** to see more detail.

5. Use the line commands to quickly access information about the DB2 objects accessed.

   ```
   LC      (Line Command)
    T      (for Table detail)
    X      (for Index detail)
   ```

   All table/index catalog information upon which DB2 bases its access path selection is easily found with these dialogs.

6. Repeat the modification and EXPLAIN of the statement for as many iterations as you need.

7. Press **PF3** to return to your edit session.

If you wish, you can now choose another SQL statement.

Compare Test Results

To find out which of the test SQL versions ran best:

1. From edit, press **PF3** several times to return to MAINVIEW for DB2.
2. Look at your trace data.

   ```
   OPTION ===> 5    HISTORY   Historical Trace Data Sets
   ```

   If you logged the trace, locate your data set here (SORT US, then LOCATE userid).

   If not, go to Option 4, Current Traces.
3. Select the trace for viewing.

   ```
   LC     (Line Command)
    S     (S to select the trace data)
   ```

   The first display **(**LTRAC**)** lists one line for each test execution (and DB2 accounting record). You can see immediately which test executions had the best performance as measured by elapsed and CPU times, as well as number of GETPAGEs.
4. Select one line for further analysis by tabbing to that line and pressing **Enter**.

   You now have the complete DB2 Accounting information at your finger tips **(**STRAC**)**. This provides you with statistics on wait times, locking, buffer pool activity, and I/O.
5. To compare this data to that from another iteration, use **PF10** and **PF11** to move to previous or next accounting record displays, without returning to the LTRAC list.
6. Tab through the expand buttons and press **Enter** to view summaries of SQL statistics, scans, I/O, or locks by table space (if traced).
7. To identify which SQL statement text was executed for this test iteration, tab to the **DETAIL** expand button and press **Enter**.

   You are now viewing a chronological list of detailed events that occurred in DB2 while processing this statement **(**DTRAC display**)**.

   For dynamic SQL, this provides you with critical data to help you relate the performance data in the trace with the test SQL you executed.
8. Tab to the **BIND-TEXT** event and press **Enter** to see the complete text of the SQL statement executed, as shown in Figure 101.

Complete Text

```
BMC Software --------------   DETAIL TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> DTRAC           INPUT    17:30:58  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> IO111256,SEQ=1,LEVEL=2                       ROW 1 OF 1 SCROLL=> CSR

START: 11:17:10 AUTH: BOLMXW2  PLAN: RXDB2    CORR: BOLMXW2      CONN: DB2CALL
================================================================================
    EVENT        AT     ELAPSED     CPU   DETAIL
-------------- -------- -------- -------- -----------------------------------
 BIND-TEXT       14.892                   *TYPE=DYNAMIC  TEXT=SELECT * FROM SY+
================================================================================
SELECT * FROM SYSIBM.SYSPACKAGE  WHERE NAME LIKE '%'
```

Figure 101. DTRAC BIND-TEXT Pop-Up Display

9. Press **PF3** to return to DTRAC.

10. Tab to the **EXPLAIN** event and press **Enter** to see the dynamic SQL EXPLAIN data, as shown in Figure 102.

EXPLAIN Data

```
BMC Software --------------   DETAIL TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> DTRAC           INPUT    12:43:58  INTVL=> 5  LOG=> N  TGT==> DB2HSR
PARM ==> MYLOCKS,SEQ=3,LEVEL=3                      ROW 1 OF 18 SCROLL=> CSR
EXPAND:  CATALOG
START: 12:32:57 AUTH: BOLSMR4  PLAN: RXDB2    CORR: BOLSMR4      CONN: DB2CALL
================================================================================
    EVENT        AT     ELAPSED     CPU   DETAIL
------------- -------- -------- -------- -----------------------------------
 EXPLAIN          5.173                  *PLAN=RXDB2    COST(1.4)
================================================================================
QUERY NUMBER: 115           EXPLAIN DATE..: 2001-03-19  12:33:0284
GROUP MEMBER: DB2H          STATEMENT TYPE: SELECT
PROGRAM NAME: RXSEL1M       COLLECTION ID.: RXD2
VERSION NAME:
WHEN_OPTIMIZ: AT BIND TIME USING DEFAULT VALUES
--------------------------------------------------------------------------------
BLKNO:   1        SEQNO:   1    MXSEQNO:   0
METHOD: FIRST TABLE
ACCESS: INDEX SCAN                          PREFETCH: NONE
 COL_FN:
 PAGE RANGE SCAN:  NO
TSLOCK: IS
TABLE: DSN8710.EMP                    CORRELATION:
INDEX:                                 MATCHING:
--------------------------------------------------------------------------------
BLKNO:   1        SEQNO:   1    MXSEQNO:   1
METHOD: FIRST TABLE
ACCESS: MULTINDEX/UNION        INDEX ONLY    PREFETCH: NONE
 COL_FN:
 PAGE RANGE SCAN:  NO
TSLOCK: IS
TABLE: DSN8710.EMP                    CORRELATION:
INDEX: DSN8710.XEMP1                  MATCHING: 1         KEYS
--------------------------------------------------------------------------------
```

Figure 102. DTRAC EXPLAIN Pop-Up Display for DB2 5.1 and Above

EXPLAIN Data

```
BMC Software --------------   DETAIL TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> DTRAC           INPUT    17:31:16  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> IO111256,SEQ=1,LEVEL=2                      ROW 1 OF 6 SCROLL=> CSR
EXPAND:  CATALOG
START: 11:17:10 AUTH: BOLMXW2  PLAN: RXDB2    CORR: BOLMXW2      CONN: DB2CALL
================================================================================
    EVENT        AT     ELAPSED     CPU   DETAIL
------------- -------- -------- -------- -----------------------------------
 EXPLAIN          19.708                 *PLAN=RXDB2    COST(4,061.4)
================================================================================
       QUERY NUMBER  115           TIMESTAMP      1996-03-05 11:17:1856
       GROUP MEMBER  DB2G          COLLECTION ID  RXD2

 BLK  SEQ DESCRIPTION
---- ---- -------------------------------------------------------------------
   1    1 METHOD: FIRST TABLE
          ACCESS: SEQUENTIAL SCAN          PREFETCH: SEQ
          TSLOCK: IS
          TABLE:  SYSPACKAGE                                  CREATOR: SYSIBM
          INDEX:                                              CREATOR:
          SORT:   NONE
```

Figure 103. DTRAC EXPLAIN Pop-Up Display for DB2 4.1 and 3.1

If you need to review the catalog information, the **EXPLAIN** expand button takes you back to RxD2 to a display of the first table accessed.

11. If needed, tab to any SQL statement and press **Enter** to see the detail row statistics.

    This can show you how many rows were accessed and whether the predicate was Stage 1 or 2.

12. Tab to the **LOCK SUMMARY** event to see an analysis of locking and lock states (tracing lock events is not necessary to get this).

13. As with STRAC, you can use **PF10** and **PF11** to move between the events produced by this test iteration.

Print Results

If you logged the trace, you may now want to print a report for desk analysis or a team SQL review:

1. Press **PF3** until you are back in the History Traces display.

2. Select the print option for your log data set.

   ```
   LC   (Line Command)
    P   (for Print)
   ```

   A panel on which you can define your print options is displayed. For more details, refer to "Print a Trace Report" on page 88.

Recommended print options for SQL prototyping are

```
LTRAC=Y                    One line identifier
STRAC=SUMMARY              DB2 accounting record summary
DTRAC=Y                    Detail events
POPUP=(BIND-TEXT,EXPLAIN)  SQL text and EXPLAIN data
```

You may want to add

```
NEWPAGE=TRAN               Start a new page per test execution
LEVEL=3                    To see all detail events
```

You may also want to print the detail summaries of STRAC in a separate report (they cannot be produced in the same report with DTRAC entries).

```
LTRAC=Y                    One line identifier
STRAC=ALL                  Complete accounting with detail summaries
```

Access DB2 Catalog and PLAN_TABLE Information

DB2 performance is dependent on three factors:

- How the DB2 system is configured (maximum threads, buffer pool, EDM pool, logging, and so on)
- The DB2 workload (SQL optimization, lock contention, I/O patterns, and service times, and so on)
- The DB2 objects themselves (tables, table spaces, indexes, plans) and the status information stored in the DB2 catalog about them

MAINVIEW for DB2 and other performance monitors mainly present data about the first two categories. Catalog and PLAN_TABLE access is usually a completely separate function. The ability to access RxD2/FlexTools directly from your BBI Terminal Session provides this information whenever you need it (subject to standard DB2 security).

Accessing the RxD2 Primary Option Menu

Access to DB2 data with RxD2 is provided from any MAINVIEW product that runs in full-screen mode, not just MAINVIEW for DB2. This includes

- AutoOPERATOR and FOCAL POINT—an operator or systems programmer can check the status of DB2 resources that may be affecting availability
- MAINVIEW for CICS—a CICS systems programmer or applications manager can investigate plans and tables used from CICS
- MAINVIEW for IMS—an IMS systems programmer or DBA can investigate plans and tables used from IMS

As described in the first session, the RxD2/FlexTools Primary Option Menu is available from most MAINVIEW applications running in full-screen mode.

- From the MAINVIEW for DB2 Primary Option Menu:

  ```
  OPTION ===> RX
  ```

- From any command line:

  ```
  COMMAND ===> RX
  ```

- From any MAINVIEW for DB2 or MAINVIEW for IMS service display:

  ```
  SERV ===> RX
  ```

Now all the capabilities of RxD2 are available for use.

Accessing EXPLAIN for Currently Executing SQL

When a DB2 application is running too long, you may want to investigate the current SQL statement being executed. The MAINVIEW for DB2 detail user (DUSER) display provides hyperlink expand buttons to perform an EXPLAIN or access existing PLAN_TABLE EXPLAIN data.

To access EXPLAIN data for currently executing SQL:

1. Access the DUSER display:

   a. Return to the Primary Option Menu.
   b. Choose Option **2**—ANALYZERS.
   c. Line select **USERS** from the list of Analyzer Display Services.
   d. Tab to an active thread and press **Enter** to access DUSER.

   Check that there is an active SQL statement displayed, as shown in Figure 104.

Expand to EXPLAIN ==>

Current SQL Statement ==>

```
 BMC Software --------------   DETAIL USER STATUS    -------------  RX AVAILABLE
 SERV ==> DUSER           INPUT    17:32:09  INTVL=> 3  LOG=> N  TGT==> DB2G
 PARM ==> MXW3                                 ROW     1 OF    96 SCROLL=> CSR
 EXPAND:  MON(USER), UTRAC, ST(START TRACE), LOCKE, EXPLAIN,  PT
          ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, SPAS, DDF
 CURRENT........17:32:09.23 PLAN..............DSNESPRR TYPE..............ALLIED
 START..........17:22:14.06 AUTHID.............MXW3 CONNECT..........TSO/TSO
 ELAPSED...........00:09:55 ORIG PRIM AUTH........MXW3 CORR ID.....MXW3
 STATUS..............IN-DB2 COMMITS.................0 ROLLBACKS..............0
 ------------------------------------------------------------------------------
 RUNTIME ANALYSIS   IN DB2     IN APPL.      TOTAL      %IN DB2(=)     TOTAL(*)
 ----------------   --------   --------   --------     0 ...25...50...75..100%
 ELAPSED TIME         430 ms   00:09:55   02:36:54     | <****************** |
 CPU TIME              64 ms      44 s       44 s      | <                    |
 DB2 WAIT TIME      00:09:14                           | ==================   |
 - - - - - - ACTIVITY - - - - - -       - - - - - KEY INDICATORS  - - - - - - -
 TOTAL SQL......................2     I/O RSP: SYNC= 3,352 us, ASYNC=    12 ms
 GETPAGES..................243,322
 SYNC I/O (PRLL= 0) ........24,225
 PREFETCH...................27,644
 UPDATES/COMMIT................0.0
 BFR HIT RATIOS:...VP= 90%,HP=  0%
- - - - - - - - - - - - - -SQL STATEMENT ANALYSIS - - - - - - - - - - - - - - -
STATEMENT #:    193                   STATEMENT TYPE:  OPEN
ACTIVE IN DB2               CPU TIME: 1,897 ms     ELAPSED TIME: 00:01:06
Package/DBRM: DSNESM68  (DYNAMIC)           PLAN ISOLATION LEVEL: RR
PROCEDURE/UDF/TRIGGER:  DSN8SPAS_TEST
  SELECT DISTINCT TBCREATOR, TBNAME, NAME, COLTYPE, LENGTH, SCALE, NULLS, DEFAUL
T FROM SYSIBM.SYSCOLUMNS C, SYSIBM.SYSCOLAUTH CA, SYSIBM.SYSTABAUTH TA WHERE C.T
BCREATOR = USER OR C.TBCREATOR = 'PUBLIC' OR (CA.GRANTEE = USER AND CA.TNAME = C
.TBNAME) OR (C.TBNAME = TA.TTNAME AND TA.GRANTEE = USER)
```

Figure 104. User Detail Status Display (DUSER)—Base Section

2. Select the **EXPLAIN** expand button.

   A qualifier panel is displayed with the SQL text from DUSER.

   If the DB2 target is on the same MVS as your terminal session, RxD2 accesses it directly (see the TARGET field). If the DB2 target is on a remote MVS, RxD2 accesses it through DDF. The TARGET name shown now is the local DB2 your RxD2 session is connected to (set in the Defaults panel) and LOCATION identifies the remote DB2.

3. If necessary, modify the query number and PLAN_TABLE owner (current SQLID).

```
Enter the query number to use ===> 1
Current SQLID                ===> your userid
```

Note: If your SQL has unqualified table names, you may need to set up special PLAN_TABLEs with the appropriate prefixes so that the current SQLID also can provide the proper table name qualifications.

4. Press **Enter** to invoke EXPLAIN, as shown in Figure 105.

EXPLAIN Output for Current SQL Statement

```
BMC Software ----------------- EXPLAIN PLAN_TABLE ------------ Row 1 to 2 of 2
Command ===>                                          SCROLL ===> CSR
                                                      TARGET ---- DB2G
Catalog Prefix   ===> SYSIBM
Location         ===> DB2G
PLAN_TABLE  . . . . : BOLMXW.PLAN_TABLE

Commands: SORT (Q,PL,PK,CO,DT)
LC CMDS:  P  (plan detail)            T  (table detail)
          PK (package detail)         X  (index detail)
          M  (more detail)
LC QNO   STP BLK MXSEQ PLAN     PGM      COLLECTION          DATE     TIME
-- ----- --- --- ----- -------- -------- ------------------ -------- --------
     601   1   1     0          RXSEL1M  RXD2                19951102 14491881
   Method: First Table Accessed
   Access: Sequential Scan                    Prefetch: Sequential
   Tslock: IS                          Access Seq(Tabno): 1
   Table:  DSN8410.DEPT                Correlation:
   Index:                              Matching    0 Keys
   Sort-New Table: None                     Composite: None
-------------------------------------------------------------------------------
     601   2   1     0          RXSEL1M  RXD2                19951102 14491881
   Method: Merge Scan Join          Full Outer Join
   Access: Sequential Scan                    Prefetch: Sequential
   Tslock: IS                          Access Seq(Tabno): 2
   Table:  DSN8410.PROJ                Correlation:
   Index:                              Matching    0 Keys
   Sort-New Table: JOIN                     Composite: JOIN
-------------------------------------------------------------------------------
****************************** Bottom of data ********************************
```

Figure 105. EXPLAIN PLAN_TABLE Output Panel

This option can be used for both static and dynamic SQL. However, for static SQL, the results may be different from the access path chosen by the DB2 Optimizer at BIND time.

5. Press **PF3** until you return to DUSER.

6. If this is a static SQL statement, select the **PT** expand button.

   A qualifier panel is displayed primed with the query number (statement number) and program (DBRM or package).

7. Your user ID is primed as the PLAN_TABLE owner.

   You may need to change this specification before proceeding.

8. Press **Enter** to view the PLAN_TABLE EXPLAIN data.

Accessing EXPLAIN from a Trace

The previous practice session, “Improve Performance with SQL Prototyping” on page 112, showed how both SQL text and EXPLAIN information is captured in a detail trace for dynamic SQL. Neither of these events is provided by DB2 for static SQL. However, direct hyperlinks to RxD2 provide equivalent information.

To access EXPLAIN data from a trace:

1. Access a detail trace that includes static SQL:
   a. From the Primary Option Menu, choose Option **4**—Current Traces (or Option **5**—History Traces, if you prefer).
   b. Line select the detail trace to view the LTRAC display of traced threads.
   c. Tab to a trace entry with several SQL statements and press **Enter** to see the accounting data for that thread (STRAC display).

2. Select the SQL Summary section by tabbing to the **SQL** button in the SUMMARIES EXPAND line and pressing **Enter**.

   A summary of all SQL executed by that thread is displayed, as shown in Figure 106.

SQL Summary

```
BMC Software --------------  SUMMARY TRACE ENTRY    -------------  RX AVAILABLE
SERV ==> STRAC           INPUT    14:27:16  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> PBCR02,SEQ=5,SQL,SORT=PGM                   ROW 1 OF 18 SCROLL=> CSR
EXPAND:  MON(WKLD), DETAIL, HISTORY
         ACCOUNTING: ENV, ELAPSED, SQLCOUNTS, BPOOL, LOCKS, PRLL, PKG, SPAS, DDF
         SUMMARIES: SQL, SCANS, IO/LOCK, SORTS

- - - - - - - - - - - - SQL SUMMARY (DETAIL TRACE ONLY) - - - - - - - - - - - -

  STMT                  AVG.     %      AVG.     %    SORT  -- PAGES SCANNED --
  TYPE   STMT  COUNT   ELAPSED  ELAP    CPU     CPU   RECS  INDX DATA WORK  REF
------- -----  -----  -------- -----  -------- -----  ----  ---- ---- ----  ----
SELECT   3228      1     25 ms   2.7  1,930 us   0.3     0     2    1    0    0
SELECT   3347      2     11 ms   2.4  4,047 us   1.5     0    11    4    0    0
OPEN     3565      6    172 us   0.1    170 us   0.2     0     0    0    0    0
FETCH    3578     11  1,986 us   2.3    782 us   1.6     0    19    3    0    0
CLOSE    3664      6    192 us   0.1    149 us   0.2     0     0    0    0    0
SELECT   3671      6  1,776 us   1.1  1,091 us   1.2     0    12    0    0    0
SELECT   3283      1  2,643 us   0.3  1,888 us   0.3     0     1    0    0    0
OPEN     3299      1    109 us   0.0    107 us   0.0     0     0    0    0    0
FETCH    3313      2    907 us   0.2    855 us   0.3     0     1    0    0    0
CLOSE    3334      1    142 us   0.0    141 us   0.0     0     0    0    0    0
OPEN     3456      1    693 ms  74.1    414 ms  74.9     8    23 1187    2    0
FETCH    3468      5    440 us   0.2    322 us   0.3     0     0    0    6    0
SELECT   4803      1  1,269 us   0.1  1,121 us   0.2     0     2    0    0    0
PGM: P025D100     44            83.9            81.0     8    71 1195    8    0

SELECT   1239      1  1,040 us   0.1  1,040 us   0.2     0     2    1    0    0
OPEN     1263      1     66 ms   7.1     47 ms   8.6   172    13    6    9    0
FETCH    1273     87    201 us   1.9    177 us   2.8     0     0    0    2    0
CLOSE    1324      1    250 us   0.0    250 us   0.0     0     0    0    0    0
OPEN     1333      1     15 ms   1.6     14 ms   2.6     7     6    4    5    0
FETCH    1343      5    254 us   0.1    254 us   0.2     0     0    0    2    0
SELECT   1375      3  1,746 us   0.6  1,165 us   0.6     0     0   12    0    0
CLOSE    1393      1    126 us   0.0    126 us   0.0     0     0    0    0    0
PGM: P025D200    100            11.4            15.0   179    21   23   18    0

SELECT    389      1     38 ms   4.2     18 ms   3.4     0    10    3    0    0
OPEN      482      1    135 us   0.0    134 us   0.0     0     0    0    0    0
FETCH     489     10    459 us   0.5    302 us   0.5     0     1    0    0    0
PGM: P025D300     12             4.7             3.9     0    11    3    0    0

** TOTALS ***    156                                    187   103 1221   26    0
```

Figure 106. SQL Summary (STRAC)

3. Select one of the static SQL statements to view the execution statistics for that SQL statement, as shown in Figure 107.

SQL Statistics

```
BMC Software --------------  DETAIL TRACE ENTRY ---------------PERFORMANCE MGMT
SERV ==> STRAC           INPUT    10:22:51  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> TEST3,SEQ=000017,SQL                ROW     1 OF    18 SCROLL=> CSR
EXPAND:  SQLTEXT(EXPLAIN)

STATEMENT:  350  SELECT                            NUMBER OF EXECUTIONS:      2
PLAN:       DSNESPRR                ELAPSED:  AVERAGE 2,794 us   TOTAL 5,588 us
PROGRAM:    DSNTIAUL                CPU:      AVERAGE 1,271 us   TOTAL 2,543 us
LOCATION: DB1D
PACKAGE:  SAJUYH2I                              --------- AVERAGES ---------
                                                   INDEX  SEQ-DATA  SEQ-WORK
                                                --------  --------  --------

          ROWS PROCESSED ALL TYPES                     4         2         0
          ROWS PROCESSED CORRECT TYPE                  4         2         0
          ROWS QUALIFIED BY DM (STAGE 1)               3         0         0
          ROWS QUALIFIED BY RDS (STAGE 2)              0         0         0
          ROWS INSERTED                                0         0         0
          ROWS UPDATED                                 0         0         0
          ROWS DELETED                                 0         0         0
          PAGES SCANNED                                8         2         0
         REFERENTIAL INTEGRITY PROCESSING:
          PAGES SCANNED                                0         0         0
          ROWS DELETED/SET NULL                        0         0         0
```

Figure 107. SQL Statement Pop-Up Display (STRAC)

4. Tab to the **SQLTEXT(EXPLAIN)** expand button and press **Enter**.

   Note: If this statement is not static SQL, the button is not highlighted. Try another statement.

   This displays the complete static SQL statement text from the appropriate plan or package catalog table. From this panel, you can choose to

   - Access existing EXPLAIN data in a PLAN_TABLE

     Your user ID is primed as the PLAN_TABLE owner. You can change it before making the request.

   - EXPLAIN the text and access the RxD2 EXPLAIN display for the statement (although this may not show the access path actually used that was chosen at BIND time)

     A qualifier panel is first displayed primed with the SQL text and query number 1. Your user ID is primed as the PLAN_TABLE owner. You can change these specifications before executing the EXPLAIN. If any host variables are in the statement, they are replaced by parameter markers (question marks) to make it EXPLAINable.

   - Execute the statement

     You can specify the maximum number of fetches, whether to COMMIT or ROLLBACK, and change the SQLID if necessary before execution.

     If any host variables are in the statement, they are replaced by question marks, and the text is presented on the Execute SQL panel to allow for tailoring into an executable format.

   Note: The same panels you have viewed previously for the RxD2 EXPLAIN are shown.

5. Press **PF3** to return to STRAC.
6. Select the **DETAIL** expand button to view the detail events that occurred within the life of the thread, as shown in Figure 108.

Detail Events

```
BMC Software --------------  DETAIL TRACE ENTRY --------------PERFORMANCE MGMT
SERV ==> DTRAC           INPUT    10:21:48  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> TEST3,SEQ=000017,LEVEL=2              ROW     1 OF    35 SCROLL=> CSR
EXPAND:  LINESEL(DETAIL), HISTORY
START: 09:17:11 AUTH: JEK1     PLAN: DSNTIB21 CORR: DB221REQ     CONN: BATCH
================================================================================
    EVENT        AT     ELAPSED     CPU   DETAIL
-------------- -------- -------- -------- ----------------------------------
CREATE-THD        0.000    45 ms 4,492 us
 PLAN-ALLOC       0.045                    ISOLATION=CS ACQ=USE   REL=COMMIT
PKG-ALLOC         0.065                   *DSNESPCS ISO=CS ACQ=USE   REL=COMIT
PREPARE   350     0.069 1,361 ms    26 ms *RC(   0) C=DT         D/X   PS(  10)
 BIND-TEXT        0.070                   *TYPE=DYNAMIC  TEXT=SELECT * FROM DS+
 EXPLAIN          0.078                   *PLAN=DSN8IC22 COST(4.6)
 EDM-REQ          1.302   123 ms 3,964 us  DB=00000258
OPEN      524     1.489   204 us   202 us *RC(   0) C=DT
FETCH     532     1.489 2,058 ms 6,247 us *RC(   0) C=DT         D/X   PS(   2)
 OPEN-TS          2.235                    DB=DSN8D21A TS=DSN8S21D
 OPEN-TS          3.352                    DB=DSN8D21A TS=XDEPT3
FETCH     532     3.549    35 ms   441 us *RC(   0) C=DT         D/X
FETCH     532     3.615   354 us   353 us *RC(   0) C=DT         D/X
FETCH     532     3.616   335 us   335 us *RC(   0) C=DT         D/X
FETCH     532     3.620   354 us   353 us *RC(   0) C=DT         D/X
FETCH     532     3.621   386 us   387 us *RC(   0) C=DT         D/X
FETCH     532     3.672   386 us   387 us *RC(   0) C=DT         D/X
FETCH     532     3.673   337 us   337 us *RC(   0) C=DT         D/X
```

Figure 108. Detail Trace Events (DTRAC)

7. Scroll down with **PF8** until you see a static SQL statement and select it to view the SQL statement pop-up display.

   This looks much like the one you saw from the SQL Summary, but is only for one execution of that statement.

   The same SQLTEXT(EXPLAIN) expand button is available here.

8. Press **PF3** until you return to the Primary Option Menu.

Accessing Other Catalog Data with Direct Hyperlinks

Analyzer displays of DB2 database objects (DBATs and DBTS), as well as the detail trace dynamic SQL EXPLAIN pop-up display, provide direct hyperlinks to the related catalog information on selected objects.

To hyperlink directly to related catalog data:

1. From the Primary Option Menu, select Option **7**—I/O Analysis and then select Option **1**— I/O by DB/TS.
2. Line select one of the table spaces.

   DBIOD—I/O Analysis by Data Set is displayed and the parameter field is primed with the name of the selected database and table space, as shown in Figure 109.

Selected Object

```
BMC Software --------------  I/O Analysis-Dataset   -------------  RX AVAILABLE
SERV ==> DBIOD            INPUT   18:33:03  INTVL=> 3  LOG=> N  TGT==> DB2G
PARM ==> TOTAL,SO=TS,DBTS=(DSN8D41A,DSN8S41E)  LINE    1 OF    4 SCROLL=> CSR
EXPAND:  I/O-DB/TS, I/O-BPOOL, I/O-VOL, LINESEL(DBTS), CATALOG
OPTION:  TOTAL, SYNC, ASYNC, CACHE


DATA     TABLE    DS/      I/O   I/O   MAX    AVG
BASE     SPACE    PRT     COUNT    %  IOWAIT IOWAIT
-------- -------- ---  -------- ----- --ms-- --ms-- 0 ...20...40...60...80
DSN8D41A DSN8S41E 004         7  25.0     98     58 | **************       |
DSN8D41A DSN8S41E 003         5  17.9     36     25 | ******               |
DSN8D41A DSN8S41E 001         9  32.1     48     16 | ****                 |
DSN8D41A DSN8S41E 002         7  25.0    112     45 | ***********          |
****************************** END OF DATA ********************************
```

Figure 109. I/O Analysis by Data Set (DBIOD)

3. Select the **CATALOG** expand button to access a primed DB2 Table Space Administration qualifier panel; then press **Enter** to display catalog information for the selected table space, as shown in Figure 110.

Table Space Catalog Data

```
BMC Software ---------------- Show Table Space --------------- Row 1 to 1 of 1
Command ===>                                          SCROLL ===> PAGE
                                                      TARGET ---- DB2G
Location         ===> DB2G
Catalog Prefix   ===> DB2G.SYSIBM

Commands: SORT (DB,TS, column no.)      GU (Group Utility generator)
LC CMDS:  A  (authorization)            Q  (generate QUIESCE JCL)
          C  (generate COPY JCL)        R  (generate REORG JCL)
          D  (drop table space)         RC (generate REORG and COPY JCL)
          KD (generate CHECK DATA JCL)  S  (show partitions)
          KX (generate CHECK INDEX JCL) T  (generate RUNSTATS JCL)
          L  (list tables within)       Y  (SYSCOPY recovery info)
LC
-- ------------------------------------------------------------------------
   DSN8S41E Status: AVAILABLE
       Database:    DSN8D41A  Segment Size: 0        Lock Rule:  PAGE
       Creator:     BOLBPL1   Page Size(K): 4        Erase Rule: N
       Partitions:  4         Using:        BP0     Close Rule: N
       Tables:      1         Active Pages: 120
       Statstime:   1996-02-01-11.05.32.584702      Space: 0KB
```

Figure 110. Table Space Catalog Display

From this display, you can use the line commands to browse all the other related catalog information for tables (L), partitions (S), indexes (per table), and so forth.

4. Press **PF3** until you are back at the DBIOR display.
5. Select the **CATALOG** expand button again.

   Here there are no selected objects. The table space qualifier panel is presented so you can choose which table space or group of table spaces you want to view, as shown in Figure 111.

Specify Qualifiers

```
BMC Software ---------- DB2 Table Space Administration -------------------
Command ===>                                          TARGET ===> DB2G

Location         ===> DB0G
Catalog Prefix   ===> SYSIBM
Catalog Table . . . : SYSIBM.SYSTABLESPACE
Specify at least one table space qualifier.

Column               Qualifier (e.g. NULL, ^='AB', >123, AB++CD*)
-------------        ----------------------------------------------------

* DBNAME        ===> DSN*
  TSNAME        ===>
  CREATOR       ===>
  DBID          --->
  OBID          --->
  BPOOL         ===>          (Buffer Pool ID)
  PARTITIONS    --->
  LOCKRULE      ===>          (A-any,P-page,T-table,S-tablespace,R-row)
  ERASERULE     ===>          (Y,N)
  CLOSERULE     ===>          (Y,N)
  STATUS        ===>          (A-available, C-check pending, I-incomplete)
  TABLES        --->
  ACTIVE PAGES  --->

                    Press ENTER to process, END to exit
```

Figure 111. Table Space Qualifier Panel

For example, in the DBNAME field, type **DSN*** to display all system table spaces.

Note: When you are finished with this exercise, press **PF3** several times to exit the EXPLAIN function. You can initiate the next exercise from any MAINVIEW for DB2 service.

Accessing Specific Objects in the Catalog

At other times, you may need information about a specific DB2 object or user that is being shown on a display of one of the BBI products. For example, you might be on a tabular display like LTRAC where a direct hyperlink is not available. Instead of writing the name down on a piece of paper to later type in a selection panel, the BBI—RxD2 interface provides subcommands that prompt you for immediate entry of the object name. If you decide not to type the name, you are presented with a qualifier panel that allows you to select a list of these objects.

To view details about a specific plan:

1. Type

   ```
   COMMAND ===> RX PL planname
   ```

   If you are in a display with a COMMAND line (for example, when viewing a DB2 message in the Log Display), you can type the plan name directly after PL on the COMMAND line.

   If you are in a display with a SERV line, just type **RX PL** and press **Enter**. You are prompted at the bottom of the screen for the plan name (for example, in the STRAC trace display).

2. Press **Enter** to go to RxD2.

   The TARGET is set to the local DB2 from your Defaults panel.

   To access a different DB2 system on the same MVS as your terminal session, specify the correct **target name** on the qualifier panel. To access a remote DB2 system (if connected with DDF), keep the TARGET pointing to any local DB2 and specify the **location name** of the remote DB2. You also can change the catalog prefix to view an alternate catalog.

3. If you specify a plan name, RxD2 displays the DB2 Plan Administration panel with one line of information about that plan, as shown in Figure 112.

Information for One Plan

```
BMC Software ---------------- DB2 Plan Administration -------- Row 1 to 1 of 1
Command ===>                                            SCROLL ===> CSR
                                                        TARGET ---- DB2G
Location         ===> NEW YORK
Catalog Prefix   ===> SYSIBM

COMMANDS: SORT (column no.)
LC CMDS:  A (plan authorization)        F (free plan)
          B (bind plan functions)       P (show plan detail)
          C (list plan collections)     R (rebind plan)
          D (show plan dependencies)    S (show DBRMs and SQL statements)

            -STATUS--                   ---- BIND ----- ---- BIND OPTIONS ----
LC PLANNAME VALD OPER CREATOR  BOUND BY  DATE    TIME   ISOL VALD ACQ   REL
-- -------- ---- ---- -------- -------- ------ -------- ---- ---- ----- ------
   DSNSTO1  Y    Y    BOLSMR2  BOLSMR2  950817 15353898 CS   DFER USE   COMMIT
****************************** BOTTOM OF DATA ********************************
```

Figure 112. DB2 Plan Administration Panel

All the line commands are available to access more detailed information.

```
LC     (Line Command)
 A     (to show plan authorizations)
 C     (to list plan collections)
 D     (to show plan dependencies)
 P     (to show plan detail)
 S     (to show DBRMs and SQL statements)
```

For example, you may need to see the plan dependencies or authorizations to find out why an application isn't running.

The plan detail and static SQL statement text are valuable when analyzing a detail trace for application tuning.

4. To view the EXPLAIN results for a specific plan:

   ```
   COMMAND ===> RX PT planname (owner)
   ```

   If you don't enter the operands, you are prompted at the bottom of the screen. You can specify the PLAN_TABLE owner, or default to your user ID.

   The EXPLAIN results are displayed on a panel from which catalog data about the accessed tables and indexes can be accessed directly.

   ```
   LC     (Line Command)
    P     (to show plan detail)
    T     (to show table detail)
    X     (to show index detail)
   ```

   For example, use this command when investigating a production plan that has been showing up in exception reports with increased run times. All the dependencies and statistics are available starting from this one screen, as shown in Figure 113.

EXPLAIN Results for One Plan

```
BMC Software ----------------- EXPLAIN PLAN_TABLE ------------ Row 1 to 2 of 2
Command ===>                                          SCROLL ===> CSR
                                                      TARGET ---- DB2G
Catalog Prefix   ===> SYSIBM
Location         ===> DB2G
PLAN_TABLE  . . . . : BOLMXW.PLAN_TABLE

Commands: SORT (Q,PL,PK,CO,DT)
LC CMDS:  P  (plan detail)            T  (table detail)
          PK (package detail)         X  (index detail)
          M  (more detail)
LC QNO   STP BLK MXSEQ PLAN     PGM      COLLECTION         DATE     TIME
-- ----- --- --- ----- -------- -------- ------------------ -------- --------
     601   1   1     0          RXSEL1M  RXD2               20010317 14491881
   Method: First Table Accessed
   Access: Sequential Scan                    Prefetch: Sequential
   Tslock: IS                          Access Seq(Tabno): 1
   Table:  DSN8410.DEPT                Correlation:
   Index:                              Matching    0 Keys
   Sort-New Table: None                     Composite: None
-------------------------------------------------------------------------------
     601   2   1     0          RXSEL1M  RXD2               20010317 14491881
   Method: Merge Scan Join          Full Outer Join
   Access: Sequential Scan                    Prefetch: Sequential
   Tslock: IS                          Access Seq(Tabno): 2
   Table:  DSN8410.PROJ                Correlation:
   Index:                              Matching    0 Keys
   Sort-New Table: JOIN                     Composite: JOIN
-------------------------------------------------------------------------------
****************************** Bottom of data ******************************
```

Figure 113. EXPLAIN PLAN_TABLE Output Panel

5. To view the details about a specific table:

   ```
   COMMAND ===> RX TB tablename | OBID
   ```

   If you don't enter the operand, you are prompted at the bottom of the screen. You can specify either the table name or OBID.

6. If you specify a table name, RxD2 displays the Show Table Objects panel, as shown in Figure 114.

Information for One Table

```
BMC Software --------------- Show Table Objects -------------------------
Command ===>                                            TARGET ---- DB2G

Catalog Prefix   ===> DB2G.SYSIBM
Location  . . . . . :
Name  . . . . . . . : SYSIBM.SYSTABLES
Type  . . . . . . . : TABLE

LC CMDS:  S (show detail)

LC
-- ------------------------------------------------------------------------

   COLUMNS        Columns In TABLE  39
------------------------------------------------------------------------
   TABLESPACE     Tablespace: DSNDB06.SYSDBASE
                  Rows: 300      Pages: 300      TS Pct: 75%
------------------------------------------------------------------------
   INDEXES        Indexes Defined For This TABLE  2
                  Primary Key Columns: 2
------------------------------------------------------------------------
   RELATIONS      Referential Integrity Relationships
                  Parent: 1     CHILD:
                  Check: OK
------------------------------------------------------------------------
   CHECKS         Check Constraints: 0
------------------------------------------------------------------------
   DEPENDENCIES   Plans Depending On This TABLE
------------------------------------------------------------------------
                  Audit: NONE  Edproc:          Validproc:
                  Statstime:  0001-01-01-00.00.00.000000
                  Compressed: -1%
```

Figure 114. Show Table Objects Panel

The S line command is available to access more detailed information. It provides access to related table space, column, index, key, referential constraint, or plan dependency data.

7. To view the details about a specific index:

   ```
   COMMAND ===> RX IX indexname | OBID
   ```

   If you don't enter the operand, you are prompted at the bottom of the screen. You can specify either the index name or OBID.

8. If you specify an index name, RxD2 displays the Show Index panel, as shown in Figure 115.

Information for One Index

```
BMC Software -------------------- Show Index ---------------- Row 1 to 1 of 1
Command ===>                                          SCROLL ===> CSR
                                                      TARGET ---- DB2G
Catalog Prefix   ===> DB0G.SYSIBM
Location  . . . . . : DB0G

Commands: SORT (IX,TB)                GU (Group Utility generator)
LC CMDS:  D  (drop index)             C  (generate CHECK INDEX JCL)
          I  (show index parts)       R  (generate REORG JCL)
          K  (show index key columns) T  (generate RUNSTATS JCL)
LC
-- ------------------------------------------------------------------------
   SYSIBM.DSNDTX01           *** RUNSTATS RECOMMENDED ***       DBID: 6
     Created As:  Primary    On Table:  SYSIBM.SYSTABLES        OBID: 61
     Subpages:    1          Cluster             Unique First Keys: -1
     Bufferpool:  BP0          Defined: N        Unique Full Keys:  -1
     Close:       N            Status:  N        Levels of Index:   -1
     Key Columns: 2            Ratio:   0%       Leaf Pages:        -1
     Type:        2          Statstime: 0001-01-01-00.00.00.000000
-- ------------------------------------------------------------------------
```

Figure 115. Show Index Panel

All the line commands are available to access more detailed information.

```
LC    (Line Command)
 I    (to show index parts)
 K    (to show index key columns)
```

Chapter 7. Printing Reports

These scenarios teach you how to print both your online and offline reports.

In this practice session, you

1. Print an online history trace and export an online windows-mode view for offline review.
2. Print offline traces from a trace log data set or SMF records.
3. Print offline Performance Reporter reports from both SMF data and DB2 tables.

This practice session takes approximately one hour to complete.

Print Online Reports

You can both print online history traces and export online windows-mode views for offline review.

History Traces (Thread Data)

In previous exercises, you learned how to run a trace and view it online. However, depending on the results, you may want to have a hardcopy for further analysis. Batch reports can also be valuable tools during an application review meeting.

Note: This section describes printing a trace, but you may also want to look at the accounting reports produced from SMF data, either from DB2 tables or directly from the extracted DB2 accounting records. See "Performance Reporter Reports" on page 148 and the *MAINVIEW for DB2 Performance Reporter User Guide* for more information.

To begin this exercise:

1. From the Primary Option Menu, select the **HISTORY TRACES** option.

   ```
   OPTION ===> 5
   ```

   This panel not only provides access to view the trace data online but also offers several line commands to simplify management of the trace log data sets:

   W Show the options used for this trace
   P Generate the JCL to print a batch report
   D Delete this data set from the trace directory
   E Reset the log data set for reuse
   V Verify that the directory entry matches the data set contents
   N Add a new data set to the directory (moved from another system)
   A Archive the data set (only if an archive started task was specified)
   F Free a data set currently being read

Usually you will need only W(SHOW), D(DELETE), and P(PRINT). We are going to concentrate now on P. You can try the others when you need those functions.

All Data per Traced Thread

To print a trace report showing all data per traced thread:

1. The history traces display shows the most recent traces at the top, but you can sort on any column and use the locate command to help you find other trace logs. For example, you can sort on userid to group all your own trace logs together.

   Now, select your trace log data set for print.

   ```
   LC       (Line Command)
    P       (for PRINT)
   ```

   The Batch Trace Print panel is displayed, as shown in Figure 116, where you can specify options to print a batch report.

Printing a Trace

```
BMC Software ------------ BATCH TRACE PRINT ----------------  PERFORMANCE MGMT
COMMAND ===>                                                    TIME --- 15:00

Update job ==> N (Y/N - update job statement)               (END to edit JCL)
Title line 1 ==>
Title line 2 ==>

Data Selection:
 From date  ==> 16MAR2001  Time  ==> 1125
 To   date  ==> 17MAR2001  Time  ==> 1412

   PLAN     ==>
   AUTHID   ==>
   CONNECT  ==>
   CORR     ==>
   LOC      ==>
   DB2PKG   ==>

REPORT SELECTION:
   LTRAC ==> NO                          (YES/NO)
   STRAC ==> NO                          (NO,ALL,SUMMARY,section1,section2..)
   DTRAC ==> NO                          (YES/NO)
   POPUP ==> NO                          (NO/ALL/SQL/event1,event2,....)
   TSUM  ==>          (A/C/L/P/T)        SORT     ==>       (for any TSUMx)
   TSTAT ==> NO       (SUMMARY/ALL/NO)   INTERVAL ==> 1H    (for TSUMT only)
   DBIO  ==>          (X/A/C/F/L/P/T/xx) IOSORT   ==>       (for any DBIOx)
                                         IOINTVL  ==> 10M   (for DBIOT only)
```

Figure 116. Batch Trace Print Panel

2. If this is your first time using this option, you must update your job statements.

   ```
   Update Job ==> Y
   ```

3. Press **Enter** to display a job statement data entry panel.

   Fill in the required information and return using **PF3**.

4. Set the Update Job option to **N**.

5. Fill in the options for a report.

   ```
   TITLE1 ==> any title   Optional. Centered in first report header.
   TITLE2 ==> any title   Optional. Centered in second report header.
   ```

Data Selection is optional. The selection fields can be used to reduce the amount printed from a long trace.

```
Data Selection:

  From date  ==> ddmmmyyyy  Time  ==> hhmm
  To   date  ==> ddmmmyyyy  Time  ==> hhmm
```

The date and time fields are primed with the start and end date-time of the trace. You can modify them to select a shorter time period.

```
    PLAN     ==> plan name
    AUTHID   ==> authorization id
    CONNECT  ==> connection name
    CORR     ==> correlation id
    LOC      ==> location name
    DB2PKG   ==> db2 package name
```

The Data Selection identifiers allow you to select only a subset of threads that you need to analyze further, such as one particular plan from a Thread History (THRDHIST) trace.

```
REPORT SELECTION:
 LTRAC   ==>  N
 STRAC   ==>  ALL             Print data per thread traced.
 DTRAC   ==>  N
 POPUP   ==>  N
 TSUM    ==>
 TSTAT   ==>  N
 DBIO    ==>
```

There are many different reports that can be generated, either singly or combined. See "Batch Trace Print" on page 143 for some examples. Browse "Printing a Trace" in Volume 3 of the *MAINVIEW for DB2 User Guide* for a full explanation of the options and to see sample reports.

The reports are based on printouts of the online displays, so the options are selected using the names of these displays, like LTRAC, STRAC, DTRAC. In this tutorial we have chosen **STRAC=ALL** as the most useful report for application tuning. It shows the following for each thread traced:

- Basic **DB2 accounting record** data
- **Environmental Indicators** section
- **Elapsed Time Analysis** section
- **SQL Statement Execution Counts** section
- **Buffer Pool Usage Analysis** section, including Global Buffer Pools
- **Lock Activity** section, including Global Locks
- **I/O Parallelism** section
- **Routines** section (stored procedures and user-defined functions)
- **DDF Summary** section (if distributed work was done)
- **Package/DBRM Overview** section (if accounting trace 7 is active)

These sections are included for detail traces that captured the relevant events:

- **SQL Summary** section with summary statistics per SQL statement (SQL events)
- **Database Summary** section with scans per page set (SCAN events)
- **Database Lock and I/O** section with locks and I/O data per page set (I/O or lock events)
- **Sort Summary** section (if any sorts were performed) (any detail trace)

6. Press **Enter** to validate your specifications.

   These options are saved in your profile and used to initialize the fields the next time this panel is requested.

   Note: Be careful! Select only the data you want to print. This report is per thread execution (like an accounting trace report from DB2PM) and can generate a large amount of output.

7. Press **PF3** to review the generated JCL in edit mode.

   The options you specified are inserted into a pattern job DZJPTRAC in BBPROF. You may want to copy this JCL into your own UBBPROF profile data set and modify it.

8. Review the remaining options.

   There are many more print options than can be shown on the panel, such as lines per page or maximum pages to print. The sample job contains a short description of these options. Scroll to the bottom to review them.

9. Submit the job.

   ```
   COMMAND ===> SUB
   ```

   Of course, if you prefer, you can **SAVE** the JCL for later execution, or even **CANCEL** it completely.

10. When the job is completed, review the output.

11. Press **PF3** to return to the Batch Trace Print panel. You can issue another request now if desired.

Other Accounting Report Examples

Here are a few examples of workload-oriented reports based on the DB2 accounting record. For quick reports submitted online through the trace print panel, you will generally select one of the trace logs created by the Thread History (THRDHIST) trace for the time period you are interested in. However, these same accounting reports can be produced from any other summary or detail trace log. See "Print Offline Reports" on page 143 for more complete batch reporting options.

- For a summary of total DB2 activity for the selected time period, you can first select an overview summary by time (broken into 30 minute intervals in this example), followed by a summary of all accounting data with useful averages, totals, and maximums for the complete period.

  ```
  TSUM ==>T
  TSTAT==>SUMMARY        INTERVAL==>30M
  ```

- To change the summary to a graphic format, edit the generated selection statements in the JCL before submitting the job:

  ```
  TSUM=T,I=30M,GRAPH=TOT (or AVG)
  ```

- For a summary by plan (or other identifier), specify

  ```
  TSUM=P     (or A for authorization ID, and so on)
  ```

  All the other summarization options of AUTHID, connect, buffer pool, location, and time are also available.

- For a quick list of each thread, specify

  ```
  LTRAC==>Y
  ```

- To generate a report of activity in each individual buffer pool per thread, specify

  ```
  STRAC==>BPOOL
  ```

  For a summary of this information per individual buffer pool for all selected threads, look at this same section in the TSTAT SUMMARY report mentioned above.

Other Detail Trace Report Examples

You may want to try other report combinations too. Here are a few examples from detail traces:

- For an SQL statement summary per thread, sorted by Average CPU usage, followed by average SQL row processing statistics per statement:

```
LTRAC  ==>  Y
STRAC  ==>  SQL,SORTSQL=AC,SQLPOPUP
```

- For a detail event trace per thread, with pop-up displays per SQL statement:

```
LTRAC  ==>  Y
DTRAC  ==>  Y
POPUP  ==>  SQL
```

- For SQL statement text and EXPLAIN data for all dynamic SQL executed or BINDs of static SQL:

```
POPUP ==> (BIND-TEXT,EXPLAIN)
```

- For a summary of I/O counts and wait times per database, table space, and plan (from an I/O trace):

```
DBIO ==> XP
```

- To summarize by plan, database, and table space:

```
DBIO ==> PX
```

There are also many formatting options you can adjust:

NEWPAGE Control page breaks

WIDTH Specify wide (133) or narrow (81) output

LINECNT Adjust the number of lines printed per page

HEADING Suppress headings

MAXPAGES Limit the amount of output to prevent an unexpectedly high print volume

Online Views

You can export any windows-mode view to a data set or print it to a SYSOUT class using the **EXPort** command. The exported view can be used to supplement performance reports or can be downloaded to a workstation for use with a spreadsheet application.

When you enter the **EXPort** command, a panel is displayed requesting an existing data set name (or SYSOUT class) and formatting options, as shown in Figure 117.

Export a View for Printing

```
----------------------------- Export Open Data Set ---------------------------
COMMAND ===>


LIBRARY (PDS):
   Project        ===>
   Group          ===>
   Type           ===>
   Member         ===>           Replace (Y/N)? YES

Other partitioned or sequential data set:
   Data Set Name  ===>
   Volume serial  ===>         If not cataloged

Export Options:
   Disposition    ===> REPLACE Replace or Append if sequential data set
   Output format  ===> ASIS    ASIS or CSV
   Lines/Page     ===> 0       ASIS format only (NNN)
   Sysout Class   ===>         If specified, overrides other data set options

Press END to save changes and export report.
Type CANCEL to return to previous panel without saving changes.
```

Figure 117. View Export Panel

The output of the **EXPort** command includes all the rows of data associated with the view, even data that requires scrolling to be seen online. However, if the logical record length (LRECL) of the data set is less than the width of the view, the view data is truncated on the right.

Print Offline Reports

You can print

- Offline traces from a trace log data set or SMF records
- Offline Performance Reporter reports from both SMF data and DB2 tables

Batch Trace Print

Most scheduled batch reporting is done with the Performance Reporter reports either directly from SMF data or from that same data loaded (often summarized) in DB2 tables. However, this data is often not available to answer questions about the DB2 workload until the next day. The batch trace print facility is designed to fill the need for quick reports. All the trace summary accounting report formats are available, in any combination.

There are different types of input:

- One or more trace log data sets

  For example, the Thread History trace.

- The archived trace logs (without reloading to VSAM)

  For example, thread history from two weeks ago.

- An SMF history file containing DB2 Accounting records or I/O trace IFCIDs
- The live SMF data sets
- A GTF trace data set

A batch utility job, DZTBTRAC, is provided in your BBSAMP data set to print these reports. There is also a sample JCL member DZTBPRNT you can use when you want to generate multiple reports or print accounting reports from SMF data. The control statements for several sample reports are provided in BBSAMP member DZJPnnnn, with comments to point out some of the most useful variations.

The trace data shown in the batch reports is in the same format and content as the online displays. This includes LTRAC, STRAC, DTRAC, DTRAC pop-ups, TSTAT, and the TSUMx and DBIOx series of displays. Many of these displays can also be combined into one report. For example, a report can consist of both LTRAC and DTRAC data. Selection options, such as plan, authorization ID, or date can be used to narrow the scope of a report. In addition, you can focus in on just one area of interest, such as buffer pool activity by individual pool.

All of the report options described in “Print Online Reports” on page 136 are also available by directly editing and submitting the batch trace print job, first specifying the input file and the reports to be printed.

Trace Print from a TLDS

To print a trace log data set, use the JCL provided in BBSAMP members DZTBTRAC, as shown in Figure 118. Specify the DSN of the log with the TLDS parameter. Multiple TLDSs can be concatenated.

Specify JCL Statements

```
//         JOB (ACCT),'NAME'
//DZTBPRNT PROC TLDS=NULLFILE,            INPUT TRACE DATA SET
//             TDIR=NULLFILE,             INPUT TRACE DIRECTORY
//             SMF=NULLFILE,              INPUT UNLOADED SMF FILE
//             GTF=NULLFILE,              INPUT GTF FILE
//             ARC=NULLFILE,              INPUT ARCHIVED TRACE DATA SET
//             PFX='HILVL.RUN.LIB'        DSN PREFIX OF BBLINK
//PRINT   EXEC PGM=DZTBPRNT,REGION=4M,PARM='GMWK=128K'
//*                                      INCREASE GMWK FOR LARGE TRACES
//STEPLIB   DD DISP=SHR,DSN=&PFX..BBLINK
//SYSPRINT  DD SYSOUT=*                  INPUT LIST AND DIAGNOSTICS
//SYSUDUMP  DD SYSOUT=*                  ABEND DUMPS
//STD1      DD SYSOUT=*                  DEFAULT REPORT OUTPUT
//*
//*    ===>    ONLY ONE OF THE FOLLOWING INPUT DD'S MAY BE SPECIFIED
//*    ===>    IF NONE IS SPECIFIED, DEFAULT INPUT IS LIVE SMF DATASET
//*
//TRACIN01  DD DISP=SHR,DSN=&TLDS         TLDS INPUT
//TRACEDIR  DD DISP=SHR,DSN=&TDIR         TLDS INPUT THRU TRACE DIR
//SMFIN     DD DISP=SHR,DSN=&SMF          SMF INPUT
//GTFIN     DD DISP=SHR,DSN=&GTF          GTF INPUT
//ARCIN     DD DISP=SHR,DSN=&ARC          ARCHIVED TLDS INPUT
//        PEND
//*
//*                     ** SPECIFY INPUT FILE **
//PRINT   EXEC DZTBPRNT,TLDS='SYS5.DB2P.THRDHIST.JUL01.T0001.V01'
//REPTDD1   DD SYSOUT=*                  USER-DEFINED OUTPUT DD
//RPTSUM    DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTWKLD   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTACCL   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTACCS   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTSQL    DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTEVNT   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTEXPL   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTFAIL   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//RPTDBIO   DD SYSOUT=*                  SAMPLE REPORT OUTPUT DD
//*SYSIN    DD *                         FOR IN-STREAM REPORT STMTS
//SYSIN     DD DSN=&PFX.BBSAMP(DZJPSUM)   DEFAULT SUMMARY RPT  (SUM)
//          DD DSN=&PFX.BBSAMP(DZJPWKLD)  WORKLOAD SUMMARY-TIME(SUM)
//*         DD DSN=&PFX.BBSAMP(DZJPACCL)  ACCTG DETAIL-LONG    (SUM)
//*         DD DSN=&PFX.BBSAMP(DZJPACCS)  ACCTG DETAIL-SHORT   (SUM)
//*         DD DSN=&PFX.BBSAMP(DZJPSQL)   SQL STATEMENT SUMMARY(D-SQL)
//*         DD DSN=&PFX.BBSAMP(DZJPEVNT)  THREAD DETAIL EVENTS (D-ANY)
//*         DD DSN=&PFX.BBSAMP(DZJPEXPL)  SQL TEXT/EXPLAIN     (D-SQL)
//*         DD DSN=&PFX.BBSAMP(DZJPFAIL)  LOCK/EDM FAILURES    (D-BASE)
//*         DD DSN=&PFX.BBSAMP(DZJPDBIO)  I/O SUMMARY BY DB/TS (D-I/O)
//*
```

Figure 118. JCL to Print a Trace (DZTBTRAC)

For detailed information about all the control statements in DZTBTRAC, see “Printing a Trace” in Volume 3 of the *MAINVIEW for DB2 User Guide*.

An example of the Accounting Summary Report produced when you submit this JCL is shown in Figure 119. It shows accounting totals, followed by a trace summary by plan.

```
BMC SOFTWARE               ACCOUNTING SUMMARY REPORT                PAGE:       2
REPORT:SUM                                                          DATE: 17MAR01
                                                                    TIME:12:16:56
- - - - - - - - - - SUMMARY STATISTICS - ALL TRACE ENTRIES- - - - - - - - - - -
-----TERMINATIONS ----------    ---------ACTIVITY-----------------------------
FIRST END..01MAR 14.37.35.21                TOTAL   AVERAGE   MAXIMUM   MINIMUM
LAST END...01MAR 14.38.45.37              --------  --------  --------  --------
NUMBER TRANS.............4    ELAPSED  00:10:20  00:02:35  00:09:12  9,695 ms
                              ELP-DB2  00:08:42  00:02:10  00:07:35  9,694 ms
NORMAL TERM..............3    CPU         21 s   5,302 ms     20 s     183 ms
-- NEW USER..............0    CPU-DB2     13 s   3,206 ms     12 s     122 ms
-- DEALLOC...............3    WAITS    00:06:53  00:01:43  00:06:11  7,678 ms
-- APPL END..............0    SQL         4,958     1,239     4,954         4
-- RESIGNON..............0    GETPAGES   27,541     6,885    27,203        56
-- DBAT INACT............0    SYNC RDS      110        27        57         0
-- IFI READ..............0    PFCH PGS   26,916     6,729    26,916         0
ABNORMAL TERM............1    UPD/COMT        0         0         0         0
IN DOUBT TERM............0    BFR HIT RATIOS:.....VP=  2%,HP=100%
- - - - - - KEY INDICATORS - - - - - - - - - - - - - - - - - - - - - - - - - -
TOTAL DDL =      4
SQL: SELECT=     0, FETCH= 4,952
SQL: DYNAMIC(PREPARE)=     1
I/O RSP: SYNC=    62 ms, ASYNC=   133 ms
LOCK SUSPENSIONS =      2

- - - - - - - - - ELAPSED TIME ANALYSIS (ACCTG CLASSES 2,3 ONLY) - - - - - - - - -

CATEGORY           #EVENTS AVG/EVENT  ELAPSED  %TOTAL
----------------   ------- --------- -------- ------- 0 ...25...50...75..100%
ELAPSED TIME                                          |                        |
  IN DB2                                7,554 ms   59.01 | ***********            |
  IN APPLICATION                        5,246 ms   40.98 | ********               |
 --TOTALS--                                13 s   100.00 | ******************** |
WAITS IN DB2 (LOCAL)                                  |                        |
  LOCK/LATCH             7    100 ms   703 ms    5.49 | *                      |
  I/O WAIT             320     12 ms 3,927 ms   30.67 | ******                 |
  LOG WRITE I/O          5  4,083 us    20 ms    0.15 | <                      |
  OTHER READ I/O         4     40 ms   159 ms    1.24 | <                      |
  OTHER WRITE I/O        0      0 us     0 us    0.00 |                        |
  UNIT SWITCH EVENTS                                  |                        |
  ..COMMIT/ROLLBK        4     16 ms    63 ms    0.49 | <                      |
  ..OPEN/CLOSE           8    159 ms 1,269 ms    9.91 | *                      |
  ..SYSLGRNG            16     13 ms   208 ms    1.62 | <                      |
  ..DATASPACE MGR        2     27 ms    53 ms    0.41 | <                      |
  ..OTHER                7  7,638 us    53 ms    0.41 | <                      |
  ARCH. LOG(QIS)         0      0 us     0 us    0.00 |                        |
  ARCH.READ(TAPE)        0      0 us     0 us    0.00 |                        |
  DRAIN LOCK             0      0 us     0 us    0.00 |                        |
  CLAIM RELEASE          0      0 us     0 us    0.00 |                        |
  PAGELATCH CONT.        0      0 us     0 us    0.00 |                        |
  SPAS SERVER TCB        0      0 us     0 us    0.00 |                        |
  Force-at-commit        0      0 us     0 us    0.00 |                        |
WAITS IN DB2 (GLOBAL)                                 |                        |
  LOCKS                 15  2,903 us    44 ms    0.34 | <                      |
  MSG. PROCESSING        0      0 us     0 us    0.00 |                        |
---TOTAL WAITS---      383     17 ms 6,480 ms   50.62 | **********             |
*NOT ACCOUNTED                          289 us    0.00 |                        |
...........

- - - - - - - - - - - - - - - - BUFFER POOL ACTIVITY - - - - - - - - - - - - - - - -
ACTIVITY                TOTAL       BP1       BP2       BP5       BP6      BP10
--------------------  --------  --------  --------  --------  --------  --------
GETPAGES............     2,545        14       592         1         6        38
SYNC READS..........       320        11         0         0         0         0
GETPAGES/READIO.....       8.0       1.3       0.0       0.0       0.0       0.0
COND. GP FAILURES...         0         0         0         0         0         0

SEQ. PREFETCH REQS.         22         2         0         0         0         6
LIST PREFETCH REQS.          1         0         0         0         0         0
DYNAMIC PREFETCHES.         16         1         0         0         0         0
ASYNC PAGES READ....       284        47         0         0         0         0
PAGES/PREFETCH REQ.        7.3      15.7       0.0       0.0       0.0       0.0
...........

BMC SOFTWARE               ACCOUNTING SUMMARY REPORT                PAGE:       4
REPORT:SUM                                                          DATE: 17MAR01
                                                                    TIME:12:16:56
                           I/O SYSTEM TRACE
          ENTRY    AVG      AVG     AVG    AVG    TOTAL    TOTAL   TOTAL  TOTAL
PLAN      COUNT  ELAPSED    CPU   #STMTS GETPGS  ELAPSED    CPU   #STMTS GETPGS
-------- ------ -------- -------- ------ ------ -------- -------- ------ ------
DSNTIA41     11   483 ms   172 ms   11.3  162.3 5,309 ms 1,889 ms    124  1,785
DSNTIB41      1    18 s  5,954 ms    1.0   20.0    18 s  5,954 ms      1     20
DSN8CC0       2 00:01:07    19 ms   12.0    7.0 00:02:13    38 ms     24     14
RXDB2         1 6,086 ms 2,633 ms  245.0  1,160 6,086 ms 2,633 ms    245  1,160
************************** END OF SUMMARY ENTRIES **************************
```

Figure 119. Accounting Summary Report

All control of the input and formatting is done through a series of keywords in the input job stream (or in a PDS member) under ddname SYSIN. Keywords that apply to all requested reports can be specified following a label of GLOBAL. Keywords that apply to a specific report must be specified following the REPORT label. An example of two report requests is shown in Figure 120.

Specify Request Keywords

```
GLOBAL  TIME=1300-1500
*
*       BIND-TEXT and EXPLAIN FROM TSO
*
REPORT  REPORTID=DAILY1,LTRAC=YES,NEWPAGE=TRAN,
        POPUP=(BIND-TEXT,EXPLAIN,OPEN),
        CONNECT=TSO,
        TITLE1='DETAILS OF BIND AND EXPLAIN',
        TITLE2='WITH STATS FROM OPEN',
        DDN=OUTPUT1,WIDTH=WIDE       COMMENTS ABOUT THE REPORT
*
*       FULL EXAMINATION OF CERTAIN SPECIAL TRANSACTIONS
*
REPORT  REPORTID=SPECIALS,LTRAC=YES,STRAC=SUMMARY,DTRAC=YES,POPUP=ALL,
        NEWPAGE=(TRAN,FIRSTEVENT),LEVEL=3,
        PLAN=(PAY+++++,ACCT1+++),CONNECT=IMSP,
        AUTHID=(USR1,USR5)
```

Figure 120. Sample Report Requests

The GLOBAL keyword TIME limits the trace output to 1pm to 3pm for both reports.

The first report prints the one-line LTRAC entry on a new page for each transaction of the selected TSO threads and the pop-ups for BIND-TEXT, EXPLAIN, and OPEN after that one-line entry for each transaction. The report is written on ddname OUTPUT1.

The second report prints the one-line LTRAC entry, the STRAC accounting summary, and all DTRAC events and pop-ups for selected plans from two specific IMS users. The report is written on ddname SPECIALS.

For detailed information about each of the request keywords you can use, see “Printing a Trace” in Volume 3 of the *MAINVIEW for DB2 User Guide*.

Trace Print from SMF Records

This same batch utility (DZTBTRAC), shown in Figure 118 on page 144, can be used to print summary trace reports from DB2 accounting records written to GTF or SMF, either from an SMF history tape or from the live SMF data sets.

In addition, the following I/O analysis reports can be produced from an SMF or GTF file that includes the I/O trace records (IFCIDs 06-10):

DBIO=X
: I/O analysis by database and table space

  Note: This report can be summarized by many different summary key combinations, such as plan, database, table space or database, table space, plan. See “Special Report Summarization Options for DBIO” in Volume 3 of the *MAINVIEW for DB2 User Guide* for examples.

DBIO=A
: I/O analysis by AUTHID

DBIO=C
: I/O analysis by connection name

DBIO=F
: I/O analysis by buffer pool

DBIO=L
: I/O analysis by location

DBIO=P
: I/O analysis by plan

DBIO=T
: I/O analysis by time interval

Note: Other detail trace events are not extracted from SMF or GTF. In addition, you cannot process SMF or GTF files in the same run with TLDSs.

Performance Reporter Reports

Performance Reporter is an offline analysis system that produces reports that can be used to evaluate DB2 system and application performance. These evaluations can be used for DB2 planning, forecasting, and performance management.

Several reports can be produced from SMF extract files without loading the data into DB2 tables. This includes accounting short and long reports and statistics short and long reports.

However, the performance data tables are the main source of historical information for Performance Reporter. You can print any number of reports produced from the summary and detailed accounting tables, or statistics, buffer statistics per pool, and audit tables.

Reports from SMF

Selective or total accounting reports, in either a short or a long format, can be printed from DB2 accounting records extracted from one or more SMF files. For example, you can select from a specific time period or by plan, authorization ID, and so on. The reports also can be summarized by various criteria.

Use the DPREPORT batch job to print accounting or statistics reports, in either a short or a long format. Figure 121 on page 149 shows sample job control statements for producing an accounting long report ordered by primary authorization ID and plan name, summarized in 8-hour intervals.

Specify Job Control Statements

```
//DPRACCT JOB
//*-------------------------------------------------------------
//*         JOB TO PRODUCE AN ACCOUNTING LONG REPORT            -
//*         ORDERED BY PRIMARY AUTHID AND PLAN NAME             -
//*         FROM 00:00:00 - 23:59:59 HOURS FOR OCT. 16 - 18,    -
//*         SUMMARIZED IN INTERVALS OF 8 HOURS (480 MINUTES).   -
//*         ONLY AUTHIDS OF BPL2X OR THOSE BEGINNING WITH CJN*  -
//*         ARE SELECTED FOR THIS REPORT.                       -
//*-------------------------------------------------------------
//STEP1    EXEC PGM=DPREPORT,REGION=4096K
//STEPLIB  DD   DSN=HILVL.DPRLOAD,DISP=SHR
//DPDACCT  DD   DSN=HILVL.ACCT31,DISP=SHR
//SYSPRINT DD   SYSOUT=*
//DPDPRINT DD   SYSOUT=*
//SYSOUT   DD   SYSOUT=*
//SYSUDUMP DD   SYSOUT=*
//SORTWK01 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK02 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK03 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK04 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK05 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK06 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK07 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SORTWK08 DD   UNIT=SYSDA,SPACE=(TRK,(45,15)),DISP=(,DELETE,DELETE)
//SYSIN    DD   *
REPORT=ACCT
REPTYP=LONG
RSMFID=SYSB
RDB2ID=DB2F
FRDATE=20010516
FRTIME=000000
TODATE=20010518
TOTIME=240000
INTVAL=480
RORDER=(PRAUTH,PLANAM)
FILTYP=(PRAUTH)
FILTR1=(BPL2X,CJN*)
//
```

Figure 121. Sample DPREPORT Job Control Statements for Accounting Reports

See “SMF Reporting Facilities (DPREPORT)” in the *MAINVIEW for DB2 Performance Reporter User Guide* for detailed information about each of the JCL control statements in the DPREPORT job.

Reports from DB2 Tables

Printing workload reports is usually done from the DB2 tables of performance data supported by Performance Reporter. This gives you long-term history and trending, as well as the full flexibility of SQL for defining your own reports in addition to the predefined set. See “DB2 Tables Reporting Facilities” in the *MAINVIEW for DB2 Performance Reporter User Guide* for more information.

Performance Reporter provides predefined reports using SQL statements, which can be run through a batch reporting facility (DPRREPT) or through QMF queries. DB2 performance charts and plots are also provided, which are available through QMF only. Other queries and reports based on the performance data tables can also be defined.

Predefined Reports

The prepared reports included with Performance Reporter show DB2 system workload to help the DB2 performance analyst, capacity planner, or service manager solve specific DB2 problems. These reports are generated from accounting, statistics, and audit data.

With these reports, standard reporting can be run on a daily or weekly basis or both.

Daily run
: The queries processed by the batch reporting program, DPRREPT, from the detail statistics (queries STxxx) and detail accounting (queries ACxxxx) tables are set up to produce a set of daily reports on the data loaded from the previous day (current date minus one). The sample JCL in BBSAMP named DPRRPT includes all distributed reports. Run these reports once, select those ACxxxx and STxxx reports you want to review daily, and create a job for this daily run.

  Note: If you do not load detail accounting records into table DMRACDTL, but only data summarized by hour or day into table DMRACSUM, delete the ACxxxx reports from the job and modify the date selection on the SAxxxx reports to produce your daily reports. The report results will be the same. Only the detailed exceptions report cannot be produced.

Weekly run
: The queries processed by the batch reporting program, DPRREPT, from the summary accounting table (queries SAxxxx) are set up to produce a set of weekly reports on the data from the previous week (current date to current date minus seven). Select the SAxxx reports you want to review weekly and create a job for this weekly run.

Any of the distributed SQL queries can be modified or used as a model to produce queries to satisfy ad hoc reporting needs. However, the flexibility of QMF, in general, makes it the better vehicle for such reporting. An added advantage with QMF is that the procs provide an easy way to select a specific time period for reporting without modifying the queries themselves.

QMF Queries

QMF can be used to run distributed reports or tailor custom performance reports and charts. A generalized QMF procedure, DZPRQRPT, runs predefined Performance Reporter queries and formats the reports using the distributed Performance Reporter forms. The predefined reports produced with QMF are the same as those produced with the batch reporting facility, DPRREPT. However, with QMF, you can select a range of dates for these reports.

Note: You must enter the QMF program to use this procedure. Detailed instructions to run and use QMF can be found in the *IBM Query Management Facility Learner's Guide*.

To run the predefined Performance Reporter queries from QMF, type the command:

```
RUN DMRPR.DZPRQRPT (&REPORT=report name
```

where `report name` is the name of the report you want to produce. For example, to run the DB2 Accounting Overview Report, type

```
RUN DMRPR.DZPRQRPT (&REPORT=ACOVERA
```

The report table date range prompts FROM and TO might appear when running these queries under QMF. Type the date range you want using the standard TSI format:

```
'YYYY-MM-DD-HH.MM.SS.TTTTTT'
```

Or, you can set global report variables by typing one of these procs:

```
RUN DMRPR.DZPRQDAT
```

```
RUN DMRPR.DZPRQDEF
```

Once you have set these global variables, they will be used by all Performance Reporter report queries for the duration of the QMF session.

To produce QMF batch reports, use the sample jobs in BBSAMP member DZPRQBAT.

Customizing Your Own Reports

Once you have used the Performance Reporter facilities to load data into DB2 tables, you may want to use your own reporting tools to create customized reports.

However, since Performance Reporter uses either QMF or a generalized report generator to provide reporting and charting facilities, the entire report is defined by the SQL select statement used to read the data tables. Thus, it is very easy to create customized reports for a specific requirement. The SQL select statements used to produce the distributed reports and charts are available, within the QMF or DPRREPT environments, as models in tailoring new reports or charts.

The JXREPT program is designed to run any SQL SELECT statement against the Performance Reporter tables and report the results.

See “Customizing Reports” in the *MAINVIEW for DB2 Performance Reporter User Guide* for more information.

One example of a custom report you may want to create is to change the time interval for reporting statistics data.

The default statistics reports show statistics by the DATETIME stamp in each record. To provide a historical view, you may want to modify the distributed reports to show statistics grouped by a longer time interval. To simplify this type of reporting, the statistics tables include columns for several other date and time values, such as DATE, MONTH, DAY, TIME, and HOUR.

Note: Data is not *spread* across intervals.

An example of a report by DATE and HOUR is in BBPARM member STOVERH, as shown in Figure 122. See “Reporting Statistics Data by Time Interval” in the *MAINVIEW for DB2 Performance Reporter User Guide*.

```
BMC SOFTWARE                          DB2 STATISTICS OVERVIEW REPORT - AVERAGES                          PAGE 0002
REPORT: STOVERH                                                                  REPORT DATE: 2001-03-25 11.14.54
DATE FROM: 2001-03-01 00:09:01                                                              LOCATION - SANJOSE
DATE TO:   2001-03-19 23:55:49                                                               SUBSYSTEM - DB2P

                CREATE PHASE 2   SYNC            SQL     SQL     SQL   GETPAGES PAGE     READ   WRITE    EDM LOG WRT    LOCK
DATE / HOUR     THREADS COMMITS COMMITS  ABORTS  MANIP. CONTROL DEFINIT   REQS  UPDATES   I/O     I/O    LOADS   CALLS  SUSPEND
--------------- ------- ------- ------- ------- ------- ------- ------- ------- ------- ------ ------- ------- ------- -------
2001-03-01 00         1     0.0     0.0     0.0     0.0     0.0     0.0     6.0     0.0    1.0     0.0     0.0     0.0     0.0
2001-03-01 01         0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0    0.0     0.0     0.0     0.0     0.0
2001-03-01 02         8     0.6     0.5     0.1     1.2     2.2     0.0   367.7   176.7   15.7     1.3     1.3     4.0     0.0
2001-03-01 03         3     0.3     1.0     0.0     0.6     0.0     0.0    64.6    30.6    1.6     4.0     0.0     2.0     0.0
2001-03-01 04         1     0.0     1.0     0.0   253.0     0.0     0.0   520.0     0.0   15.0     0.0     2.0     0.0     0.0
2001-03-01 05         1     2.0     0.0     0.0     1.0     0.0     0.0    10.0     0.0    8.0     0.0     0.0     0.0     0.0
2001-03-01 06        14     1.0     0.0     0.0     1.0     0.8     0.0    17.3     0.0    4.8     0.0     0.2     0.0     0.0
2001-03-01 07        10     0.6     0.7     0.0     1.4     1.5     0.0   304.6   168.1    4.7     2.4     0.0     3.4     0.0
```

Figure 122. Statistics Overview Report by DATE and HOUR

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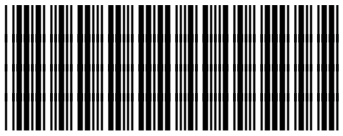

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